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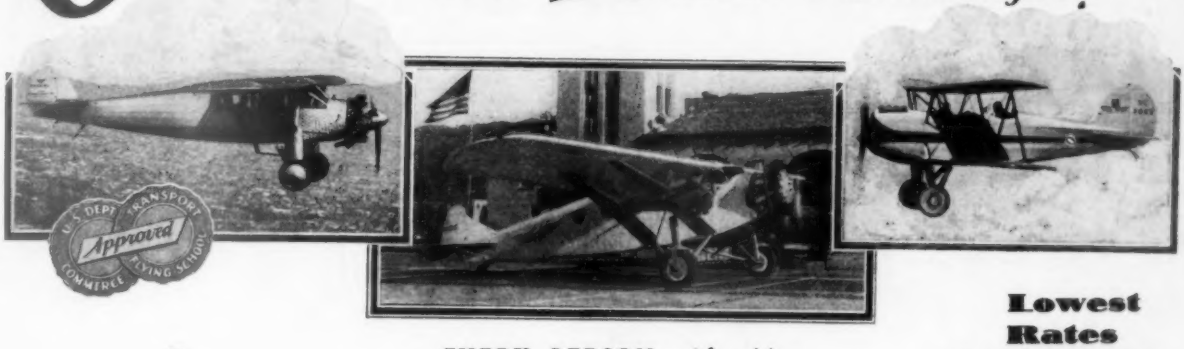

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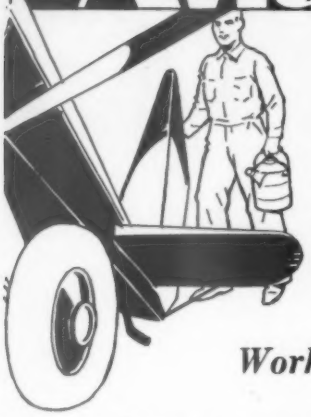

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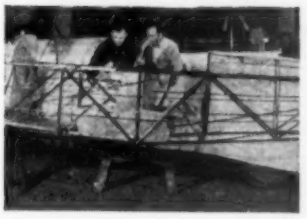

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LINDBERGH LEARNED

An Airy Chat With the Editor

IT would help a whole lot if we could print this department on a special kind of elastic rubber paper so that it could be stretched out far enough and long enough to hold everything that should be printed.

Something is always being omitted that should have been printed, and when the next issue gets around, the subject is so old and stale that it has to be dropped altogether. Just for example, the Christmas exchanges should have been run in January, but at the last minute I was reluctantly compelled to chop out these announcements.

You know the kind. One fellow has got a lot of something that he wants to trade with someone who has a surplus stock of something else. We welcome these trades and sales as a general rule, but last month there wasn't room for them. Sorry.

* * *

WE have a war story with us this month that deals with the little radio shacks that were labeled "T. S. F." As you old-timers know, this is the abbreviation for "telegraphie sans fils," or "telegraphy without wires."

They usually had a big quenched spark transmitter that went all over the dials and everything else, and were more noted for getting general orders all balled up than they were for the transmission of intelligent messages.

Well, as this story goes, a certain American aviation unit got quite peevish about a nearby German T. S. F., and they went out to bust it clean off the map. And they did. This German sawmill was strafed plenty, but the strafers were strafed in turn, ending up in a free-for-all that supplies the zest of the story.

* * *

JUST as we predicted in a preceding issue, the inventors have been using their spare time during the depression to do a little intensive inventing. And the total result has been most interesting. In cases where they haven't clipped off the tail-group altogether, thus creating tailless ships, they have taken the tail and stuck it out in front, thereby giving the ship the name of "canard." This is not strictly new—but anyhow it is a change.

I'll bet one thing, and that is, that the canard "tail-first" ships are going to cause a whole lot of confusion in traffic. You can't tell now what direction a plane is going to take off—tail first or tail last.

* * *

THERE are eight pictures grouped in this issue that will prove of great interest to aviation fans and collectors. These are the photos of the brand new 1932 models of the U. S. Army Air Corps ships. All of them are much faster than the models that they succeeded, and a number of them are highly formidable fighting machines.

* * *

JUST lean back in the old armchair and loosen up your collar a bit, before we start this one. It will take a lot of your attention, so you might just as well be comfortable. This letter, from Chester Decker, Secretary of the North Jersey Glider Club, 34 Cambridge Pl., Glen Rock, N. J., is most interesting. He addresses you as follows:

On page 122, of your December issue, you mentioned sending a petition to Congress on the subject of regulations governing the age of pilots.

This letter has nothing to do with the age limit for flying power planes, but it does concern certain objectionable regulations applying to the flying of gliders. As you probably know, after January 1, 1932, all gliders must be provided with a stress analysis sheet and must also be licensed before they can be flown.

Now, I have no quarrel to make with issuing licenses to gliders, for I believe it is perfectly fair and correct, but to be compelled to furnish a stress analysis sheet of all the parts entering into the glider will prove to be a tremendous handicap to all the glider clubs in the country.

This will do more to hinder gliding than any other thing they could do except to ground all of the gliders all of the time. It will completely eliminate all backyard gliding, which is really the first and most important step in learning to glide, and which is the foundation of all future flying experiments.

Further, any fellow soloing in glider building will certainly be discouraged when the few companies now in the industry, having approved gliders for sale, quote prices on their plans. I am hoping that it is possible for you to start some sort of a campaign, or circulate a petition, asking Congress to ease up on the stress analysis law.

It would be possible to reach fellows in all parts of the country through your magazine who are interested in gliders but who, of course, are now inactive because of the law. If a petition could be submitted to Congress concerning this trouble I am sure it would prove successful because even in my town alone there are about 15 fellows who are directly affected by this law.

Well said, Chester. I'm sure that most of our readers will agree with you in part and some will agree to all the points raised. The glider fans in this neighborhood feel much as you do about it. What do you say, fellows? Let's hear from you on this subject.

* * *

BEFORE we leave the subject of gliders and gliding, we wish to call your attention to what seems to be a bargain. It is written by William Brown, Jr., of Fall Creek, Wis.

I wonder if you will please print the following in the Airy Chat. I have a good prinary glider, complete with safety belt and 100 feet of half-inch shock cord, all for $75.00 cash. Crating for shipment by rail, $5.00 extra. Will send pictures to anyone that means business.

Possibly there are a few in our family who are looking for just such a trade, and if you are, then write to the address above. We haven't seen the glider, so we can't give you any more details.

* * *

YOU'VE all heard about chasing bootleggers and smugglers on foot, with patrol wagons, taxicabs and all sorts of land vehicles, but in this issue of POPULAR AVIATION, we are running an article describing how the U. S. Coast Guard deals with these violators, using the seaplane as the means of attack.

As might be expected, the rum runners and smugglers employ many clever ruses to deceive the Coast Guard pilots, so it resolves itself into a battle of wit against wit, with varying results. This story is quite entertaining and instructive.

* * *

LIGHTPLANE builders, both those with ships already under construction and those contemplating construc-

(*Continued on page* 132)

XUM

POPULAR AVIATION

A Magazine for the Promotion of Amateur Aviation and Private Flying

Volume X FEBRUARY, 1932 Number 2

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T-S-F must be

by ALFRED WOODSON

Day after day, the scouts failed to locate a mysterious enemy radio station —T-S-F. Then, mostly by accident, it was located, and with it, was found a hornet's nest of Fokkers.

OFFICERS at General Headquarters were frankly annoyed. A new and menacing enemy radio neighbor had planted himself in some concealed spot from which came an uninterrupted stream of "Dit-dit-da, Dit-da-dit," in some incomprehensible jargon. Day and night this mysterious German "T. S. F." kept on the job without the slightest apparent relation to present or subsequent events.

There must have been a reason for all this expenditure of good radio energy, but so far the officers of the Intelligence Division—code experts—had failed to unravel the mystery. They were all acquainted with the deep crashing messages emanating from the huge German headquarters radio station at Nauen, but this other pest was something else and possibly heralded some new advance agent of destruction and death.

Then, alternating with the gibbering "dit-dit-da, dit-da-dit," came another peculiar series of waves at regular intervals. It was just as if some automatic sender were hooked up to the key, sending out a regular beat of "zzz-zah, zzz-zah, zizz-zah, zizz-zah," ten minutes at a time. Patrol after patrol had been sent out with orders to pick up this weird transmitter, but one by one they had returned without finding it, or even getting a trace of the disturbance.

Had this occurred in 1932, or even five years after the war, the enemy station could have been quickly located with precision by the direction finders, but at this time, no effective directional radio compass had been devised. It was simply a case of sending out scout after scout until some fortunate discovery would disclose the enemy transmitter.

* * *

A TWO-SEATER Spad was assigned to the job after the scouts had been turning in negative reports for more than a week. And, in the rear of this two-seater was a box of tricks which, headquarters had hoped fervently, would solve the vexatious problem. It was just a little radio receiver of improvised design that might give a clue to the enemy's location.

In general, the idea was this. The nearer the Spad flew to this station, the louder would be the signals in the headset of the observer. The farther away he would fly, the weaker would be the signals. Ideally simple, at least in theory, but rather questionable in practice amidst the uproar of the engine and the whistling of the slipstream past the observer's ears. Organized resistance would certainly be met—it always had been—and then there would be more difficulties for the observer to contend with.

To handle the guns, listen into the radio signals with a cumbersome and annoying headset about his ears, and to concentrate his attention upon the relative strength of the "dit-dit-da's," was too much to expect from one man. At least so figured Hank Brody, the gunner, observer and the selected victim for this expedition.

And so, after a long and vehement argument, in which Hank's voice could be heard in a crescendo, it was finally decided to pick out some light-weight junior to share the tribulations of the rear turret with Hank. This assistant, or accomplice, was to confine his attention to the strength of the signals, while Hank was to handle the guns as usual and to keep a lookout for enemy interference. This was a tight fit in the rear cockpit, but it had to be done if the program were to be carried out.

And the job was not so nice for the radio-man, either, for it meant that he would be compelled to lie entirely inside without a peek at what might be going on around him. It is enough of a strain when a man can see just what is happening, but when he hears the guns spatting without knowing whether his ship is a victor or a victim is still worse.

* * *

BREVERTON MILLS, the British Royal Air Force pilot, was to handle the ship. Billy Skelton, an American attached to the R. A. F., was duly selected as the radio investigator, largely because of his physical stature, which, to say the least, was space conserving. Hank, of course, was stationed as before.

Billy Skelton's twenty-one-year-old heart was beating so hard and fast that he wondered if he were scared. He decided that maybe he was, but then this did not matter; this adventure was what he wanted more than anything else in the world. The boy licked his parched lips, quenched his moist hands and hoped and dreaded.

It took a long run to take off with Billy's additional weight, but they made it and were soon in the region of Bapaume, where it was suspected that the German radio station had dug itself in. Just behind them, and to the left, were four single-seater Spads that had been enlisted for the protection of the two-seater. Ten minutes had passed peacefully in this survey without the slightest apparent interest on the part of the enemy.

Billy, through his headset, heard the radio signals distinctly, but there was not so very much difference in their intensity at any position. Finally, after carefully listening and estimating, he extended his hand toward the south. Hank immediately communicated this signal to the pilot who turned face about in obedience to instructions and made for the invisible objective. Five minutes more of peaceful flying, and the "Dit-dit-da" became distinctly stronger and sharper. At least they had the direction, even though they still lacked location.

And then it broke! While he could not see, Billy felt Hank stiffen up quickly to attention and then felt him turn the gun around in the aft position, quickly followed by a burst of "Rat-tat-tat-tat" from the gun. Gone was his concentration on the radio signals, and off came the headset in the anxiety following this latter development. And Hank was not at all gentle. He tramped about the circle with the gun. He was without regard for Billy's feet, face or hands.

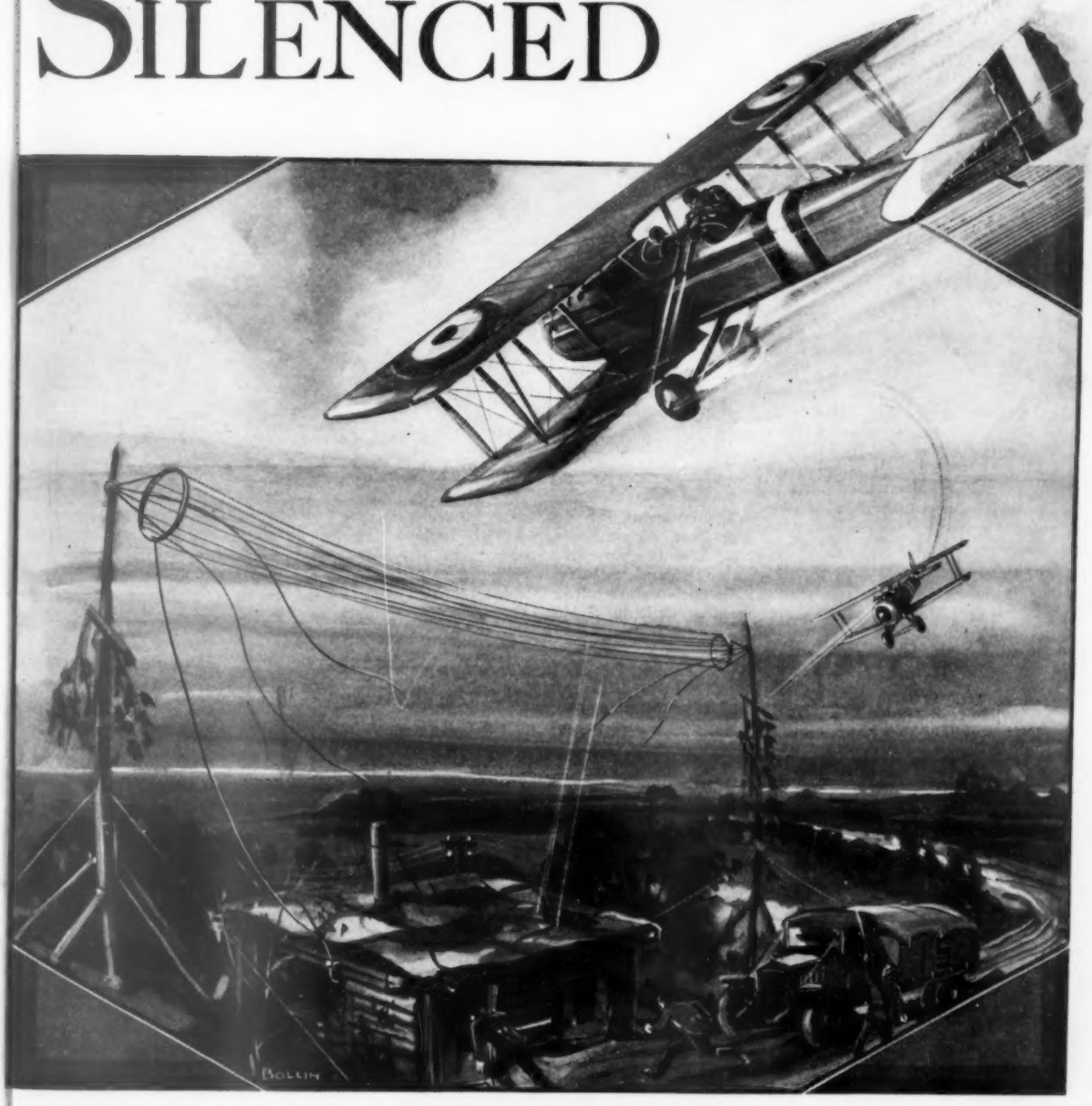
Now, over on the right wing tip. Now, over on the left. Nose down. Nose up, while the "Rat-tat-tat" continued in spasmodic bursts. What were they doing out there? Were they outnumbered? How was it going? It was bad enough to stand up in the open, like a man, but to be shot down like a rat in a cage was unspeakable.

Then, across the opening above him, through which Billy had heretofore only been able to catch a glimpse of clouds and blue sky, flitted a flash of red and a black cross. Almost immediately came a splintering sound beside him, then another and then another. Now he caught a view of trees and scarred earth through the opening, while his straps, suddenly tightening, told him that the ship was on her back. He felt as if his stomach were taking leave of him altogether while invisible bristles moved chillingly on his spine. Were they shot down?

Now came the clouds and blue sky again through the opening, another flash of a black cross—and then a trail of black smoke. Hank had stopped firing for some seconds now and was no

SILENCED

Illustrated by Herman R. Bollin



Concentrated fire from the rear guns quickly silenced T-S-F., but revenge was soon to follow.

longer tramping around in the circle as before. Billy's heart again sank. The legs beside him were no longer straight and tense—they were sagged and bowed. What did this mean? He looked past the struts, and saw for the first time—a tell-tale splatter of red.

Now he threw away the headset, and struggled mightily to get upright beside Hank. It was a difficult matter, in that confined space, to move the limp body far enough aside to gain a standing position—but he did it. He did not dare to look at Hank when he forced his head through the gun ring, and fortunately enough for his presence of mind, Hank slumped down limply into nearly the same space that Billy had occupied just a few seconds before.

Now, that thought of horror was erased from his mind as he viewed the action about him. One Fokker here, one Fokker there, a Halberstadt in front and an indistinguishable wing tip just below. Then came three Fokkers charging vengefully toward him. Strange—he caught no view of his escort, nor any Spad at all. Were they all down—or what?

In desperation, he swung the turret gun around and lined it up with the three Fokkers that had now shifted to the right. Right into the middle of the bunch—no time to aim now—and then, "Rat-tat-tat."

Perhaps it was a sudden spasm of "hunter's fever" that caused the sudden swing into action, but no matter what the reason, Billy blazed away madly at everything that came within his view.

And, marvels to behold! One Fokker nosed down, a bright flare and a burst of black smoke from its cowling. Then over on one wing tip and finally into a dizzying spin to earth in a shroud of black smoke. Forgotten was the radio mission, a blind rage seized him

as he glimpsed the limp form below. Hank was a good fellow. They shall pay for this. And then all his nervousness and hesitation left him—just as though out with cold water.

Mills, the pilot had enough. He waved back to Billy and went into a dive. Then out of the dive, and pointed her toward home. Billy now saw that their escort was master of the situation—far to the rear and above him—and Mills was taking no unnecessary chances with the overloaded two-seater. Billy had his initiation into a good old-fashioned Fokker attack which he was reviewing with mixed feelings until they landed safely on the home field.

* * *

After landing, it was found that both Scott and Fredericks were missing. Hank Brody was sent back to the base hospital, severely but not fatally wounded. The two-seater was ripped up along the bottom of the fuselage but was not beyond repair. But, saddest to say, their mission had been a failure and the German radio signals continued just as before. Some more work to do tomorrow on this job and probably on the day after that. Possibly with greater losses and always with greater risks.

* * *

TEN days more had passed and the menace was becoming unbearable. The code, if there was one, could not be deciphered nor could any motive be found for this strange transmission. Had it been an ordinary transmitter, used for the purpose of communication, the matter would not be so annoying. It was the suspense and a vague fear of an unknown peril that was eating away at the nerves of the staff. Thoughts of a devastating death ray or wave were always with them.

And so, a bigger and more intensive reconnaissance was ordered. Five squadrons were to comb the terrain about them simultaneously until the German broadcaster was located and destroyed. Three of the bombers were equipped with improved radio receivers for the search, with every possible effort being made to settle things once and for all.

The plans for the day contemplated a broad sweeping line ten miles wide and in such force that enemy interference was not likely to interrupt the program. The depth to which the squadrons were to penetrate the enemy territory was left to the discretion of the squadron leaders in charge of the raid.

* * *

BILLY was again the occupant of a two-seater Spad, but in another role. He now held the controls for the first time since becoming a member of this squadron. For this trip into enemy territory he was paired up with two single-seat Spads, Jerry Middleton flying one, while the other was handled by Stanly Fairbanks, a friend of Billy, who had completed his training at the same camp in U. S. A. Two other sin-

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German Transport Has Windows in Wings

Front view of Junkers transport plane, showing wing windows.

FOR about ten years, or more, we have been entertained with various predictions regarding the accommodation of passengers within the thick massive wings of the future transport ship. The subject of these imaginative yearnings was generally a tailless ship with everything, including the power plant, carried in or by the wings.

Now we have a huge Junkers transport ship that has gone at least part of the way to meet the above predictions. Its enormously thick wings are deep enough to carry freight and express matter, and in order to provide the light necessary for stowing away the baggage, a few windows are placed in the leading edge of the wings as shown. So far as we know, the wings are not yet made thick enough for the comfortable accommodation of passengers, for the passengers sit in the conventional cabin in the conventional way.

Laurence Hargraves, A Pioneer in Aviation

IN A QUIET corner of a graveyard in Sydney, New South Wales, lies the remains of one whose work has been of tremendous importance to the flying world. He lived to see his ideas accomplished, but the sad neglect that was his portion broke his heart, and he died in the early days of the great war, a victim of the thoughtlessness and stupidity which has killed so many scientific men.

Laurence Hargraves was born in England in 1850, and when his family emigrated to Australia in 1858, he remained behind at school, going out in 1866. On his arrival, his father apprenticed him to an engineering firm where his genius for mechanics soon showed itself. A little later he became an assistant at the Sydney observatory, and it was the work he had to do while there that directed his attention to the study of currents of air.

This study led him to consider the problems connected with flight, especially human flight, and the solution of these problems became his life's work. In 1884 he wrote a paper on flight—"The Trochoided Plane"—and presented it to the Royal Society of New South Wales, where a few scientific men read it and promptly forgot it. But this neglect did not deter him.

From 1884 to 1892, he experimented with monoplane models made from light wood and tissue paper. The earliest was constructed on the bird principle (Ornithopter) with flapping wings. For the motive power of these models, he used, progressively, clock-work, rubber-bands in tension, then compressed air, and lastly—steam. One of the models, shown before the New South Wales Royal Society in 1885, flew two hundred feet. A later model, for which he designed a compressed-air engine, flew a greater distance—three hundred to four hundred feet.

The compressed air and steam engines, that were designed to drive the models, were extremely simple and light and were marvels of ingenuity. Had Hargraves done nothing else, he should be remembered for his models. When he found his models unsatisfactory, one reason being that he could not make them rise from the ground, he turned his attention to a new idea and began experimenting with kites. Finally he hit upon the box-kite which made him famous.

Hargraves saw what other men had not seen—that the string attached to the middle of an ordinary kite, balanced

(*Continued on page* 126)

XUM

Old Man Aviation

AIRMEN from all sections of the United States know Grover Olds, Lorain, Ohio, as "Old Man Aviation." To others he is just a busy workman who labors daily over his bench, building miniature ships of the air.

This former wartime pilot hears no roar of motors nor the applause of the crowds as he ponders over his blueprints, and yet he is playing a mighty important part in aviation's march of progress.

Many of the leading airplane manufacturers, in every section of the country use Old's wooden models to make tests in miniature of what they plan to do in actuality—full size.

"Old Man Aviation" has had an interesting and exciting flying career, beginning far back in the days when aviators were merely county fair barnstormers. In 1916, he assisted the engineers who designed the famous Liberty motor, and afterwards served in France with the 341st Bombing Squadron.

After the war had ended, and aviation once more resumed its peace time activities, Olds began making miniature airplanes. In a short time, his skill was brought to the attention of manufacturers who called on him regularly for scale models of the new ships they were planning to build.

These models serve two purposes—advertising display and models for test planes. The latter models require a tremendous amount of work for they are extremely delicate and are built accurately to less than one-hundredth of an inch.

The airplane engineers then put the miniatures through series of rigid wind tunnel tests. This determines their stability and performance before any actual full size construction is started.

A manufacturer, desiring a certain model, submits a series of blueprints to Olds and this is the beginning of a period of precise and painstaking labor. Sometimes weeks are required in the building of one tiny plane, and many times Olds has fashioned a dozen pair of wings before one is found perfect.

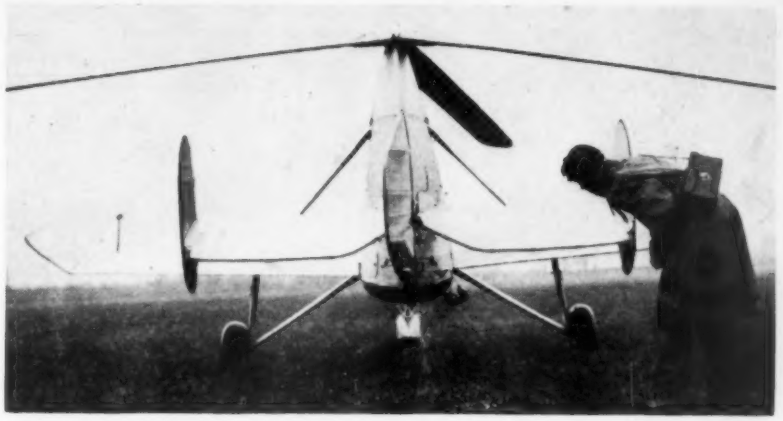
Some of the miniature models are extremely valuable costing as much as $1.000. Even the cheapest run from $50 to $150.

Whenever there is an aviation show in progress, one may be sure to find a number of famous flyers grouped about "Old Man Aviation" and his glittering display of miniature airplanes.

Hope She Makes It

CHINA'S only woman aviator plans to make a flight across the Pacific Ocean to America next spring to return the aerial visit of Col. and Mrs. Charles A. Lindbergh to the Orient. She is Miss Wang Kwei-Fen, who won her American pilot's license in New York last year. She announces the Chinese National government will furnish her an airplane and the necessary funds for the flight.

Autogiros Are Developing Rapidly



A new English Autogiro as seen from the rear. Note the vertical fins on stabilizer and the upturned wing tips.

WITHIN the last two or three months much development work has been accomplished on the "flying-windmill" problem, both in this country and Europe. In our last issue we showed a decided improvement made in the direct-lift type machine by Stauffer of Elkhart, Ind.

This month we show two more new additions to the direct-lift family, one being an English development of the Autogiro while the other is an American machine equipped with feathering rotor blades. In both cases, the objective is to improve the speed range.

The English machine shown above is remarkable in the fact that it has a streamline pylon with double vertical fins and a single central rudder at the end of the fuselage. It will also be noted that the tips of the wing are upturned and that the wing span is considerably larger than in the original autogiro. This is the Autogyro C.19 Mark IV.

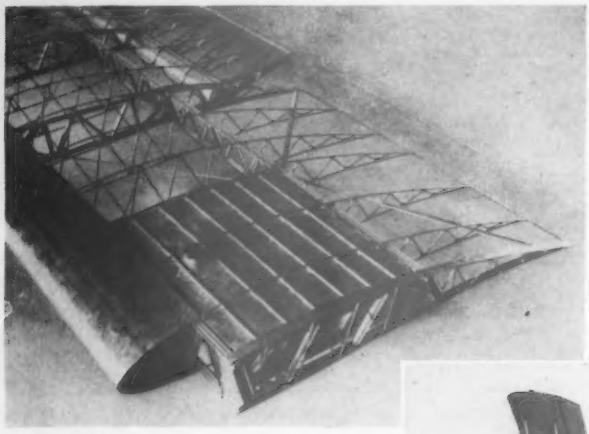
The American machine, shown below, is the Wilford Gyroplane. The wings of this ship are very much longer than on the Autogiro and are equipped with ailerons. Further, the angle of the rotor blades, in the plane of rotation, is under the control of the pilot which is most useful in making vertical descents and take-offs and also for handling it on the ground under bad weather conditions.

When the ship is being driven forward at cruising speed, the wings take up the main burden of the load and the rotor is slowed down. The blades of the rotor can then be turned into the horizontal so that they present a minimum of resistance.

This rotor control, in combination with the wings, gives lateral balance in vertical descent.

The American Wilford Gyroplane in flight. The rotor blades are controllable, giving better stability and added safety.

Stainless Steel Airplane Construction



+ + +

At the left is a wing and wing tank built of stainless steel, shot welded.

+ + +

Below the completed stainless steel flying boat in flight.

+ + +

THE Pioneer, so called because it is the first airplane to be constructed of stainless steel, was recently christened at the New York Seaplane Base, Long Island. The ship is an amphibian of the Savoia-Marchetti type, and is large enough to accommodate four persons.

Non-corrosive steel has been in use for some time in airplane construction, but due to many difficulties in riveting and welding, it has never been used for all parts of a plane. Tests have proved that riveting weakened non-corrosive steel and the usual type of welding detracted from its qualities.

Many companies have experimented with a method known as "shot-welding," which leaves the stainless steel unharmed. Non-corrosive steel is regarded as superior to high tensile steel and duralumin for plane construction because it is practically immune to rust and excessive motor vibration.

Airplane Saves the Day

IMAGINE several score men marching down the main thoroughfare of Detroit. Bugles trumpeting, drums beating and hundreds of thousands of spectators lined on either side of the street gaping at the unusual spectacle—paraders without pants!

The eve of the national Legion convention at Detroit found the Jeannette, Pa., bugle and drum corps in a drastic predicament. The breeches of the men's uniforms had been given to a cleaning establishment, and the pants were ruined!

The manufacturer of these trousers was several hundred miles away. It looked as if it was either parade sans pants or a withdraw from the bugle and drum contest.

Frantic heads got together. One chance was left. They took it. A plane was chartered and sped on its way toward the distant city to the manufacturer where new pants were to be had. Hearts awaited eagerly, eyes scanned the skies as the hour drew near.

At the last moment, a speck appeared in the heavens and the plane settled down amid an excited group. Packed within were the necessary articles! The day was saved! The Jeannette bugle and drum corps was spared the ignominy of parading without pants!

Observes Weather from Ship

THE United States Weather Bureau has just awarded to Johnny Starr, pilot of Tulsa, Okla., a contract to make daily observations of weather conditions. Starr will ascend to 14,000 feet above Omaha, Nebraska, each morning, and at that altitude make readings of wind velocity, humidity, temperature, barometric pressure and other weather data, which information will be turned over to the Omaha Weather Office for dissemination throughout the country.

He will use a Spartan Monoplane in the new work.

And Then the Pies Flew!

EDWARD ROCKNEA, Angola, N. Y., found that he didn't escape the troubles which sometimes beset auto drivers when he bought himself an airplane. Rocknea was arrested in Erie, Pa., as a hit and run airplane pilot, and his plane was attached by Erie county until he paid for damages to a pie truck.

Rocknea tried to land in a field near Erie, but misjudged the size of the plot and the plane ran onto a road, striking the pie truck and overturning it. Rocknea gave it the gun and soared into the sky, and when he landed in another field a little later he was arrested.

Private Flying is a Joke in France

DISTANCE acts like a magnifying glass and focusses public attention on what is going on abroad. Quite often the result is undue praise of the foreigner and sharp criticisms of domestic institutions.

Unfortunate as it may be, aviation is subject to that same distortion. We have read many unfavorable comparisons with Europe that would never have been made, had their authors been a little more familiar with the craft of the "Old World."

Let us now consider French aviation. It holds more records than ours and breaks frequently into the headlines of the daily press. Its face and prestige run high but that is no reason we should be awed by it, especially by its South American activities. Indeed, the "*Aeropostalle*," the air-mail system of France, nearly went bankrupt last winter and has been lately reorganized as a government owned line.

Once in a while we read about the growing popularity of private flying in France, and the help it receives from a paternalistic government. As printed, is looks like the real stuff, from across the ocean, but take up residence there, and try to fly for pleasure. Then the fun begins.

First of all, you want a plane and are told "Dad" government will pay two-thirds of its list price and will also help pay the running expenses. It all sounds very good to you until you look up the catalogues and discover that:

1. There are no "real" lightplanes on the French market that are eligible for government subsidy.

2. That the socalled "sport" jobs are performance machines designed for trained military pilots rather than for amateur private owners. Low landing speeds and "forward-downward" visibility are, as a rule, sacrificed to speed and maneuverability.

3. That regular training planes are built to higher safety factor than the military machines and are therefore so heavy that it is a nightmare to fly them.

In short, for pleasure, you'll have to fly planes suitable for military service and no others.

Next, you will want to learn to fly, bearing in mind, the tolerance of the U. S. Department of Commerce as to length of training, examinations and test. However, in France, under the air ministry regulations of April 8, 1931, you are required to:

1. Show proof of a minimum of 30 solo landings.

2. Land with a dead stick within 490 feet of a stick or buoy after switching off your engine at 2000 feet above the landing area.

For the private seaplane pilot license, you must know all about tides, currents, use of life-saving apparatus at sea and the regulations for the prevention of

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Qualifications of a "Big-Time" Pilot

by Capt. Chas. W. Purcell

Wonderful prospects are opened to the young pilot by the big airlines, according to Capt. Purcell. His advice, therefore, is to "keep your eyes on the big stuff."

Hopping a big one on the United Airlines. Note the fog creeping over and obscuring the earth at the left.

TO EACH and every rookie in the flying game today comes the longing to "hop" some of the "big stuff," in other words, to fly the big fast mail and passenger planes.

Most of you youngsters are wondering how you can get on one of these lines and, in your present frame of mind, you probably think it necessary to have some particular kind of luck to attain this ambition. This, in the language of the day, is a lot of palookism. There is no such thing as luck when it comes to getting on the big stuff.

You have to aim at this particular kind of flying from the first day you get a stick in your hands. You will have to keep your eyes on the big ships and be sure they don't cross. Sometimes our eyes get to doing things. One eye will do what you wish while the other goes on a still hunt for a bottle of gin, and when this happens you can kiss your ambitions good night. No airplane line in the world will hire a man who fights booze—and you can lay to that.

The next thing that airlines insist on is a perfect body and mind. These are easy to get if you keep in training, and both are very necessary when you have a big "crock" in your hands. One thing that makes a good flyer is the ability to think quick and fast. The air allows only one mistake.

There is no room in the flying game today for guessers. You must know what you're doing from the time you leave the ground until you get back on it again. You can't try one thing and then try another if that particular thing doesn't work.

I think that more accidents have been caused in the flying game today by last minute changes of mind than from any other cause. This shows a lack of grey matter in the dome and is one reason why women will never fly big jobs on the passenger runs. They lack the necessary nonchalance when under forced draught.

Keep your eyes on the big stuff, youngster. Any chump can fly small stuff and get by with it, but it takes a man what am a man to fly lots of airplane. This is one variety of flying that brings home the pazoozies, and we don't mean perhaps or but.

I think I hear some one asking, "Just what are these 'big jobs' you're talking about?" That will be explained in the following paragraphs, so plain that even a woman can understand it, and believe you me that's making it as plain as it can be made.

Now then. One of the crack jobs on the Pacific coast is the new speed run on the Varney Airlines from Oakland to Los Angeles, and from Oakland to Sacramento. This outfit is equipped with new Lockheed low wings, and the author is under the impression that the bimbos who make our dictionaries will have to coin a better word than "speed" to explain how fast this ship travels.

THE Los Angeles run is just about three hundred and forty miles and the schedule for the run is one hour and fifty-eight minutes. That is the scheduled time but it means nothing in the life of the pilots. The average time that most of the pilots take to make it is one hour and forty-five minutes. This brings to mind a little story.

One of the pilots on this line, Jess Hart, pulled out of Los Angeles one day with a full load of six passengers. Everything was "Rosy and Jakey," so Jess sat back and watched the landscape until a fog rolled in under him. Then he started to play with the radio, picking up a lot of things that float around the air in these days of radio.

About one hour later he looked "over," trying to pick up the town of San Jose through the holes in the fog. This young man got the surprise of his life. He was just passing over the Sacramento river, some forty miles beyond Oakland where he was to land his load. He had arrived some thirty minutes ahead of schedule, and he swears by everything in the world that he only had 1,850 r.p.m. on his tack all the way up the coast.

He had to circle and get back to his field, but with all this overshooting, he completed the run in one hour and thirty-three minutes.

This line is hiring nothing but crack pilots. By "crack pilots," we mean those who have never had a crack-up. They require these pilots to have five thousand hours of passenger time before they're considered as one of their future employes. They must have a good standing with their insurance company, which means that their reputation must stand a real investigation. They must have made no mistakes in the flying game to date. In other words, these pilots must be the kind of men that women dream about.

This is the only line in the country that pays ten cents a minute for each minute over the time schedule at arrival. To date they have payed no premiums due to late arrivals. Any pilot, flying on this run, would never live through the kidding he would get from the rest of the gang if he brought one of these Lockheeds in late.

SOME of you youngsters probably wonder how the pilot knows when his landing gear is ready for action on these new ships. Well, it's like this. When the pilot gets his ship off the ground, he rolls up his landing gear and a small green light on his instrument board comes to life. That light stays lit as long as the landing gear is folded.

Now, you may think that something might happen to the light. True enough, but if the light goes out, and he gets ready to land with his landing gear still folded, something else will happen. As soon as he shoots the throttle back to a closed position, a funny sounding horn brings him to life quick and the darn thing blows until the gear is put down.

Next, on the "big plane" job list, is the United Air Lines. This company

has one of the biggest passenger planes in the country, and it is their boast that not one of their senior pilots has ever killed a passenger.

The above sentence has a flat sound to it until you stop and think that the five senior pilots of this company have an average of 9,643 flying hours each. To the above statement you can add another interesting fact. They have never had a major cack-up in their thirteen to fifteen years of flying. Now, do you youngsters see what you have to shoot at when you try for a position on the big planes?

Many of you kids, who are flying today, will end up on these big runs, but you'll have to work to get there. The thought may enter your mind at this stage of the game that these men are too good to replace, and that you'll never get a chance. Phooey, and some more phooey.

Do you think these birds can live forever? They finally die of gout, sore throat or old age and the last is the one big thing that will make room for some of you youngsters who are in the game today.

About ten years of flying is all that the big outfits allow for a senior pilot and a new crop is due pretty soon. And there's nothing stopping some one of you fellows from climbing into a good job whenever you make up your mind to go after it.

The United Air Lines is the one big outfit in the United States that seem to see beyond the horizon. They know that the old crop of pilots is fast disappearing and so they have started schools to raise another crop for their ships. These youngsters are being put on a co-pilots with the old timers after they graduate from the flying school.

When they finally take the controls, they will have added to their own experience, the experience of their master pilot instructors, and this is something that cannot be laughted off.

"YOU may wonder why you have to go through so much training when you already have several hundred hours. Well, just put yourself in the place of a big company. Would you hand a ninety thousand dollar ship over to a young pilot, and tell him to fly it without being sure he was capable? We'll tell the cock-eyed world you wouldn't.

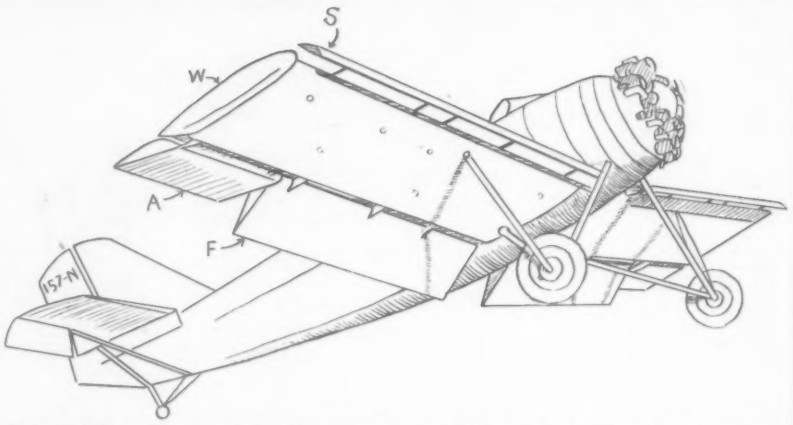
When a pilot walked up to you, and told you he had seven hundred hours, you'd probably bark, "Seven hundred hours, why man, you'll need seven thousand before I'll even talk to you." We doubt whether you could sleep much at night even if the pilot had seven thousand hours, with all that money in the air.

Then, we have another job of flying. This one isn't fast nor so big, but it requires a lot of headwork. We are going to tell you of this one just to show you how much a human head can be made to do when you use it.

(*Continued on page* 120)

Principles of Slotted Wing Explained

By A. A. THURSTON



View of slotted wing monoplane with slot at (S), main wing at (W), Aileron flap at (A) and interconnected wing flap at (F).

WE HAVE had so many inquiries from readers who evidently have not been able to decipher the meaning of sectional drawings that we have decided to show the essential parts of a slotted wing airplane in picture form.

In the accompanying sketch, the wing slot is shown running along the entering edge of the wing as at (S). This slot is supported by the small brackets extending into the main wing (W) and swings back-and-forth automatically into the proper position.

At the rear of the wing will be seen the hinged deflector flap (F) that is operated in combination with the wing slot. The flaps add much to the lifting ability and efficiency of the slot.

At the tips are the usual ailerons (A) which are employed in the usual manner for maintaining lateral balance. The aileron flaps, of course, are under the control of the pilot and are connected to his stick control. This ship is of the same general type as the famous "Doodle Bug" that created such a sensation by its slow speed and short distance landings and take-offs.

For further information on this very interesting subject, we are quoting a number of questions and answers taken from "A Wing Slot Catechism," recently published in the Handley-Page Bulletin—Handley-Page is the inventor of the wing-slot arrangement.

Q. In what different forms is the Handley-Page wing slot found in modern aircraft types?

A. In three chief forms; the auto-control slot, the lift slot and the interceptor slot.

Q. What is the purpose of the auto-control slot?

A. Its chief purpose is to increase the safety of the aircraft to which it is fitted.

Q. What is the purpose of the lift slot?

A. Its chief purpose is to obtain improved efficiency for the aircraft at high angles of incidence. It is often found in conjunction with an interconnected wing flap, as in the Handley-Page "Gugnunc" and in the "Doodle-Bug." In this form it gives wide speed range and enables a high top speed to be obtained at the same time as a low landing speed.

Q. What is the purpose of the interceptor slot?

A. Its chief purpose is to increase the pilot's control over his aircraft at all times and particularly at and near the stall. It is therefore of the highest value to fighting aircraft which must often maneuver rapidly when near their ceiling.

Q. What action is required on the part of the pilot in order to make the slots work?

A. No action whatever. In all their forms the wing slots are entirely automatic.

Q. Are wing slots applicable to all types of aircraft, monoplanes and biplanes and both thick and thin wing sections?

A. Yes. Tests have been done with all kinds of wing sections and with both monoplane and biplane forms of construction and it has been found that slots are applicable to all types and that they function equally well in all types.

Q. Can the increased control which slots provide be obtained by any other means?

A. No. Wing slots are the only means of obtaining increased control at and near the stall.

The flying qualities of the slotted wing monoplane are striking in a gentle wind. The writer has seen them hover, over one spot for minutes at a time in a breeze, and has witnessed them climb at an angle of almost 45 degrees without much forward motion.

XUM

The Gas Made Famous by Airships

by WALTER E. BURTON

Thanks to helium gas, the modern airship is safe and practical. Mr. Burton, student of airship development, gives us some valuable dope on this interesting gas.

IF THE Navy had to fill its new airship, the Akron, with helium gas at prices prevailing 17 years ago, there would be no money left to operate battleships nor to carry on any other naval activity for a long time to come.

In 1914 helium sold at $2,500 a cubic foot, it being at that time a very rare gas. At that rate the Akron, with its 6,500,000 cubic feet capacity, would require $16,000,000,000 worth of helium! Even if such an enormous amount of money were available, it would have been otherwise impossible to fill the airship a decade and a half ago. There simply was not enough available helium at that time.

But conditions have changed, and today there is an ample supply of the second lightest gas known — probably enough for a hundred or more years to come.

Helium first made its appearance as a brilliant yellow line of light. In 1865, a group of scientists were observing the sun's corona during an eclipse. For the first time they turned a spectroscope on the chromosphere of the sun—that part of the sun's atmosphere which merges into the corona. Through the instrument they saw a bright line of light that none of them had seen before.

"A new element," they decided, and seeking a name for it, they selected "Helios," the Greek word meaning "Sun." This, they modified, into the chemical word—"helium."

It was not until nearly 30 years later that Sir William Ramsay, eminent English scientist, found the same yellow line in a sample of gas obtained from the radio-active mineral cleveite. This is the first time that helium was known to exist on earth.

Although no agreement has been reached concerning the exact origin of helium, it is known to occur in several substances. The earth's atmosphere contains one part in 185,000. Small quantities of the gas are found in sea and river water. Mineral springs produce it in small amounts.

Volcanic gases sometimes claim it as a constituent. In Italy, for example, a volcanic source of sufficient helium for filling airships has recently been found. Thus, Italy is the only country other than the United States, or perhaps Canada, where helium occurs in any considerable quantity.

Attaching Manifolds and Pipe Lines to the Steel Cylinders Filled with Helium Gas. This Shows a Crew Inflating a Dirigible.

The most fruitful source of helium, however, is natural gas and this is the source of all the commercial helium obtained today. This natural gas, by the way, is not always the kind that can be burned in stoves. It more often is non-burning carbon dioxide or nitrogen, or combinations of these and other gases.

The town of Dexter, Kansas, in 1903, was like most other Kansas towns in the fact that its housewives cooked meals on coal or wood fires. But Dexter had heard of the wonders of natural gas, and longed to obtain an adequate supply.

Then, one day, the happy news spread that a well had been sunk and that a supply of gas at good pressure was tapped. Everyone rejoiced. No longer would potatoes have to be boiled over a hot wood or coal range. The mayor announced a celebration to mark the first igniting of the new gas.

At the appointed hour, the population assembled in the center of the town where a gas torch had been arranged. The mayor made a speech, then applied a match to the burner. The match was blown out.

"TOO much pressure," the celebrators decided. So they built a bonfire. A few seconds after the gas was turned on—the fire was out! Although many housewives saw their dream of an easy life vanishing, everybody considered the event a joke—on the mayor. So he, in an effort to redeem himself, sent for Dr. H. P. Cady of the University of Kansas.

Dr. Cady analyzed the Dexter gas and found that it was made up mostly of nitrogen—better as a fire extinguisher than as a fuel. But of far greater importance was his discovery of helium in the gas. Here, tapped for the first time, was a source of the rare gas that could be used if ever there was a job for it to do.

Our citizens of Dexter soon forgot the celebration that had been a flop; and the world forgot Dr. Cady's discovery of helium.

Then came the war, and one night in 1914, the gunners who protected London were unusually unfortunate in bombarding a German Zeppelin raider. The airship did not seem to mind the shells that would ordinarily have set hydrogen gas on fire.

So the British decided that the Germans had found a gas that would not burn, and that it was practically as light as hydrogen. It later was learned that this guess was not correct, and that the gunners had simply failed to hit the Zeppelin—or at least to fire its gas.

The incident, however, served to arouse English interest in helium. The gas was studied intensively, with the result that English experts soon knew more about America's helium than the Americans themselves.

When the United States entered the conflict, the English information on helium was turned over to this government. Establishment of helium-extrac-

tion plants followed, and when the Armistice was signed, there was a shipment at New Orleans docks ready to leave for Europe.

Scientists still are puzzled about the real source of helium. One theory has it that radioactive substances, in breaking down throughout the ages since the earth was formed, have created the helium that now lies entrapped in the earth. Another theory dismisses the matter by assuming that the gas simply was there when the earth was formed, like any of the other elements.

HELIUM is best known for its use in airships. It is slightly heavier than hydrogen, the lightest element known, but possesses the advantage that it will not burn. Major airship disasters, such as the destruction of the English R-101, Roma, R-38, and the Dixmude, were traceable to the use of explosive hydrogen gas. If this gas had continued to be the only available lifting gas, the science of airship construction and operation probably would now be a dead one.

Helium, having larger molecules than hydrogen, does not diffuse through fabric as easily, and therefore retains its purity or "lift" longer. The weight of 1,000 cubic feet of helium is 11 pounds, or 64 pounds less than air, so that the lift of this quantity of gas is 64 pounds. In the Akron, containing 6,500,000 cubic feet, the maximum lift is 432,000 pounds. Helium in the ship itself weighs 71,500 pounds, or a little better than 35 tons.

The Helium Company has calculated the helium requirements for an airship the size of the Akron for one year as follows:

Initial inflation to 90 per cent capacity...	5,850,000 cu. ft.
Operating reserve of 50 per cent.....	3,250,000 cu. ft.
Make-up to replace loss of 60 per cent.....	3,900,000 cu. ft.
Total	13,000,000 cu. ft.
Of this, there would remain at end of year	9,100,000 cu. ft.

Four airships, accordingly, would require about 23,400,000 cubic feet, plus the reserve supply, which still remains at 3,250,000 cubic feet. At $35 per thousand cubic feet, plus $5.00 per thousand for freight, this would cost $1,066,000. Then, about $2,163,000 for storage, cars, purification equipment, etc., would be required. The total helium cost for four airships for a year, including purification costs, would be $1,105,800.

SO, you see, there would have to be a sound financial foundation for the operation of a fleet of commercial airships such as is now being planned for trans-oceanic service.

Hydrogen gas costs about $2.50 per thousand cubic feet, and the loss is about 40 per cent per month, or 500 per cent a year. At that rate, the gas costs about $300,000 less per ship than helium. But, assuming that a hydrogen ship can be insured in this country—which it cannot—the difference in insurance rates would more than offset the difference in gas cost. Therefore, helium actually is more economical to use than hydrogen, all costs considered.

Reduced load-carrying ability, because of the lower lift of helium, is offset by the better stream-lining, possible in helium airships.

(*Continued on page* 124)

A portable helium purifying plant that separates and purifies the helium when it has become mixed with air by leakage in the ship.

Airplane Stop-and-Go Light

Showing stop-and-go light in service.

A NEW stop-and-go light for airports has been recently designed by the U. S. Bureau of Standards and is shown in operation by the accompanying photograph.

It consists of a cylindrical casing surrounding the lamp, supported at both ends by two pistol grips. Pressing one of the triggers causes the red light to show while the other trigger controls the green light.

After aiming it at any plane on the field, the pilot will either "give her the gun" for a take-off or else stops his ship. This is a very convenient arrangement because the beam of the signal may be instantly directed to any part of the airport.

Crash-Proof Fuel Tank

OFFICIALS attached to the Bureau of Standards are eagerly experimenting in search of a crash-proof fuel tank for airplanes. These laboratory experiments are being conducted with a tank lining of synthetic material resembling rubber zut. This is insoluble in gasoline or oil, is elastic and extremely strong.

The ultimate goal of the scientists is the development of a tank which will not burst and deluge the pilot and plane with fuel in case of a crack-up.

Weather Reporting Service

THE United States now has the most extensive weather reporting service of any nation. For the benefit of flyers on commercial transport lines, weather reports are received from 200 first-order weather stations two times daily. These reports, in combination with the upper air reports, are used in making the zone forecast. In the accompanying picture we see a pilot receiving weather data and advice from the operator seated at one of the teletype machines. The weather reports come off the tape of the teletype machines which give almost instantaneous connection with the reporting station.

XUM

How I Broke the World's Record Jump

by BERT WHITE

As told to Legette Blythe

How it feels to walk out of the door with five miles of empty space yawning below you.

WE WERE 27,000 feet up. That's a long way, too. Three miles back and below us, lay the Cleveland airport, where thousands of folks attending the National Air Races were watching us—or had been until we went out of sight. We were advertised for an attempt to break the world's parachute jump record, which I held. I was out to beat the 24,800-foot record I set on May 25, 1930, over the Mojave Desert.

I looked at George. George Quick of San Francisco was my pilot, and a darn good one, too.

George was beginning to get loggy. I could see that. It was terrifically cold, although our cabin Bellanca was tight and had a heater. We were wrapped up head and ears. The weather folks had given us reports of the temperature for every so many thousand feet. At 30,000 feet up, they had told us, it was fifty degrees below zero. We figured at 27,000 feet that it was at least thirty degrees below. And to a couple of fellows from the west coast, that's cold.

We had been corkscrewing up from the airport in ever widening circles. The climbing was getting to be pretty slow. We were hardly gaining any altitude. The cold was beginning to get under our skins, despite the heavy togs. I had been sucking my oxygen steadily and was feeling first rate, but George, I could see, was getting drowsy.

Then the controls froze up. We couldn't get any higher. That was a cinch.

I looked across at George again. He nooded. I eased over, felt of my straps, gave the old boy a pat on the shoulder, and opened the door. It was as cold as blue blazes. I peaked down below.

Five miles straight down! It's a long way, I'll tell you. I might be a long time getting down there, I thought to myself, or I might take a precious few seconds doing it. I didn't know. If she opened, O. K. If she didn't—well, it would soon be over.

Nobody had ever done a parachute leap—or any other kind, I might add—from such a tremendously high altitude. There were many conflicting opinions about what would happen if one should jump from an airplane five miles above the earth. Of course, since it had never been done, nobody could say positively what would be the result should it be attempted. It was my job to find out.

In making my preparations over a period of more than two months to attempt to break my own worlds parachute jump record, I had talked with many noted aviators about atmospheric conditions found in very high altitudes.

Bert White, at the right, is standing beside his pilot, George Quick.

I had asked various flyers about the possibilities of such a drop. I was of the opinion, naturally, that a parachute would function properly many miles above the earth. My old 'chute had stuck with me in a lot of tough places. I was confident she would let me down all right.

Major John A. Macready, famous army flyer, and one of the comparatively few pilots who have done much flying in very high altitudes, was pessimistic about such a jump. "Bert," said he, "I don't think much of trying that jump. It may work and then again it may not. I wouldn't want to advise you that there is no more than the ordinary amount of danger in such a jump."

The major explained that the upper atmosphere is heavily charged with static electricity. You know silk and electricity get along together about as well as a bull pup and a Persian kitty. It was altogether possible, he thought, that the friction brought about by the 'chute's rapid descent through this static electrical field might cause a spark that would set the 'chute on fire. And where would I be, hanging to a burning bag of silk five miles above the ground?

Well, as I opened the door and looked down upon serene old Mother Earth so far below, I thought about what the major had told me. There's no need denying that. But I was confident my parachute would open and wouldn't catch on fire. And in case it didn't open, I'll have to admit, I had another I would use. If one burned up, perhaps the other wouldn't. Perhaps.

I took a deep draw on the oxygen, clamped my mouth shut and dived out.

It wouldn't be long now at any rate until I would know what was to happen.

The freezing air whipped up past me, stinging the few uncovered square inches of my face like sharp little icicles. I was hurtling earthward at a sickening speed. The thin air was letting me slip through like a bullet. But this was for only a second or so. Clear of the ship, perhaps a hundred and fifty feet below it, I gave the rip-cord a vicious jerk. Now she would burn if she was going to.

She trailed out, filled and billowed into a perfect circle. It was a great and glorious feeling, I'll tell the world.

And then I passed out. The press dispatches said I fainted. Well, probably that was it. Have you ever been on a real, honest-to-goodness drunk? Or have you taken ether? I guess it was somewhere between the two. Anyway, as I floated downward, I floated off.

I had run out of air. That was all. The two lungsful I had grabbed from the oxygen tank had given out. And now the air was too light to give me enough oxygen to support breathing.

Perhaps I dropped four or five thousand feet—about a mile, I guess—before I came around. I floated back into consciousness as I had floated off. I was coming out of the ether, rousing out of the drunk. I looked up and there she was, the best looking thing I ever saw.

A lot of pretty sights I have seen. All California has to offer, including the bathing beauties. But the most beautiful sight I have ever cast my eyes upon is a circle of white silk billowing out above me and that parachute letting me down upon Cleveland, Ohio, was as pretty as any of them.

That, I guess, was the greatest thrill of my vagabonding career. I have doubled for Gary Cooper, Hobart Bosworth, Karl Dane, William Haines and a bunch of others, and am lucky to be alive. But that jump to a new world's record, when I didn't know whether my preconceived theories would work out or not—seeing that 'chute unfold above me—gave me my most tremendous kick, I'm certain.

We had taken-off from the Cleveland airport about two-thirty that after-

noon and I figure we were an hour and ten or fifteen minutes reaching the 27,000-foot ceiling.

George and I had determined that I wouldn't land anywhere near the airport. It would be perilous, indeed, to come down among all those planes. They were there by the dozens, doing every sort of acrobatic maneuver. Some of them might not see me, and I might drop gently into a fast-whirling propeller. So we agreed to aim at some field quite a distance from the crowds. For that reason, George flew the ship three miles across from the airport and I was to drift with the breeze back toward it and past it for my landing.

There was a fair breeze, in fact a pretty strong one, and instead of landing anywhere near the airport, I floated thirteen miles onward to a landing, standing upright in a field. It was an unusually deserted place, too, but by the time I hit the ground I guess there were five hundred people there to meet me.

It doesn't take very long to tell about a parachute jump. There's not much to it. Either you come down like a shot—if she doesn't open up—or you come down a little more leisurely. There isn't much time consumed either way. And if you come down the first way you don't tell anything.

The time element in the jump at Cleveland, however, was considerable. The usual jump requires only a minute, or two, or three from the time you dive until you land. The jump at Cleveland took forty-three minutes. In that time I came down five miles, but in doing it, floated sixteen miles across country. I was really moving sideways three times as fast as I was dropping.

And although it doesn't take much time to make a jump and not long to tell about it, it requires much time and considerable thought in careful preparation for the test. Every jump, as a matter of fact, is a test.

But it wasn't a stunt. That is where the general public has the wrong idea about this parachute jumping. "I wouldn't risk my neck," a man will tell you as he cranes his neck to see a fellow bail out, "but if that darn fool is willing to take a chance, just to give me something to look at, well, I don't mind watching him."

But as a general thing, the parachute jumper is like the pioneer in other fields. He is an explorer. He is the man to go there first. He is the fellow to try something. If it works, the world is all the better off for the knowledge it has received. It has learned something that may be of great value. If it doesn't work, there's one parachute jumper less—and the world knows what to avoid. But it doesn't have to listen to the jumper's alibis, that's a cinch.

The jump I made at Cleveland is an example. Nobody knew what would happen. Some of the best flyers thought disaster would overtake a jumper bailing out from such a dizzy

(*Continued on page* 122)

The Nicholas-Beazley Trainer Gets Certificate

It will be seen that the NB is easily entered and that there is little to obstruct the vision.

A DEPARTMENT of Commerce Approved Type Certificate, No. 452, has recently been granted to the Nicholas-Beasley trainer Type NB-8G. As will be seen from the photograph, this is a high-wing monoplane of neat design. It seats the pilot and passenger side-by-side in a roomy cockpit, easy access being had to the seats through a door and a convenient step.

Both wings can be folded back, swivelling on hinges, so that very little hangar space is necessary. With the wings folded, the ship occupies a space 11 ft. wide, 8 ft. high and 23 ft. long. It only takes five minutes to swing the wings back, and they can be locked securely in flying position. The wings are of the fabric covered wood type with plywood bracing and seven internal compression members.

It is equipped with a five-cylinder Armstrong-Siddeley Genet, Mark 2, engine provided with a supercharger. The American rating of this engine is 80 h.p. at 2,310 r.p.m. A high speed of 110 m.p.h. and a cruising speed of 85 m.p.h. is attained by this powerplant. Fully loaded, the landing speed is 38.2 m.p.h. while the climbing speed is 750 ft. per minute.

NB-8G SPECIFICATIONS

Span	37 ft., 6 in.
Length, overall	20 ft., 3 in.
Height, overall	7 ft., 9 in.
Weight, empty	717 lbs.
Useful load	493 lbs.
Gross weight	1,210 lbs.
Power loading	15 lbs./h.p.

A high arch V-type hydraulic landing gear, equipped with air-wheels, is standard equipment. The control surfaces give exceptional control at low speed, and it has been found that the ship will not spin unless deliberately forced into it by the pilot. It will then come out of the spin of its own accord if left alone. It lists at $1,790.00.

Clever Work in Ballooning

A UNIQUE free balloon flight, in which the landing was made within 200 yards of the take-off, was made by Captains M. E. McHugo and Orin J. Bushey, Air Corps, at Scott Field, Ill.

The take-off was made with a light surface wind from the east. After traveling about 10 miles toward St. Louis, the pilots sent the balloon up to an altitude of about 4,000 feet, where a northwesterly wind took them to about 15 miles southeast of the field.

Valving gas, the balloon was brought lower into a southeast wind, and this brought the 35,000 cubic foot bag back to the field. The time of the flight was exactly two hours.

Snakeskin for Seats

A NEW use has been found for snakeskin—covering for airplane cushions. A large transport plane, now used on some of the lines of American Airways, is equipped with this new kind of upholstery. Besides its durability, snakeskin is lighter than leather and saves many precious pounds in airplane weight.

Beacons for Southern Trail

TRANSCONTINENTAL night flying over the Southern Trail will soon be made possible by the installation of ground beacons on the Dallas-Atlanta stretch.

Thirty-three new beacons were recently placed in operation on the dark gap between Phoenix and El Paso. Now the airmen will have a completely lighted path extending from Los Angeles to Dallas.

The new ground beacons are operated by electrical solar clocks and automatically turn themselves on and off each evening and morning. They are, in themselves, complete units, able to function properly for a month or more without human assistance.

Army Planes Help with Mail

DURING the recent general strike on the Southern Pacific railroad in Mexico, distribution of mail over the area served by the railroad went on uninterrupted. The government loaned the national postoffice department six Army fliers and four planes to move mail between Guadalajara and Nogales, Ariz., terminals of the railroad.

Over Ice and Snow at 100 M. P. H.

A highly ingenious powered-snowboat. Designed for winter travel by Father Nestor of Cando, N. D.

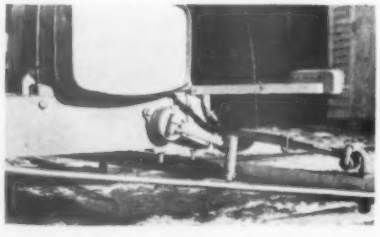
SKIMMING over the ice and through the snow at the rate of 100 miles per hour in a power-propelled sled has always had a strong appeal to the lover of outdoor life. For winter transportation, this mode of locomotion has a zest and exhilaration not possessed by other vehicles, not even by the sailed ice-boat—the thrill boat of former years.

Now, there are snow-boats and snow-boats, but the snow-boat that forms the subject of this article is a snow-boat deluxe, well worthy of the attention of those who must traverse the snow-bound districts of the north for pleasure or business reasons. It is more than the plaything commonly built for winter service—it is a really practicable, speedy and comfortable vehicle for all purposes.

This ingenious arrangement is the design of Father Nestor, Cando, N. D., who has solved many of the problems of winter travel. He uses it to travel through his parish, which extends over a large territory, with members scattered here and there, at comparatively great distances. Finding that the local vehicles, ordinarily used for winter travel, were practically useless under many conditions, he determined to build a machine that would successfully combat the snow-blocked roads—and here it is.

Father Nestor's experience convinced him that the only reliable all-winter machine is an air-propelled sled. Thereupon, he went shopping for a 65 h.p. engine, but a fortunate chance enabled him to buy a good Curtiss OXX6, 100 h.p. aviation engine, at a reasonable price. This engine, hooked up to a war-surplus, 150 h.p. propeller, completed the power plant, and with this material at hand, he immediately set to work on the plans.

The success or failure of such a machine depends upon the weight and the strength of the sled. Many persons have made the mistake of building the sled so heavy that the power-plant was unable to handle it. Hence, Father Nestor turned to aircraft engineering in working out the design, and upon seeing the plans, Mr. Bacon, the owner of a local garage, invited the Father to use his machine-shop and equipment for the construction. Ed Crume, the shop foreman, also rendered invaluable service in building the machine.



A view of the real axle system.

+ + +

The occupant is well protected and has full vision, as will be seen at right.

+ + +

Below is a close-up of the power-plant and engine cowl.

+ + +

To begin with, this snow-boat is built around a frame, consisting of two hickory sills, 11 feet long, bolted with steel plates to cross-pieces. The width of the frame at the front is eight inches, while the rear width increases to 33¾ inches.

The engine mount, the two seats and steering mechanism are secured to these cross-pieces, while six 2 in. by 2 in. hickory studs elevate the engine bed 35 inches above the frame. Aircraft wire and turnbuckles are used for guys, while steel tubing is used for the braces, giving a very light, but strong, engine mount.

Spruce is used in the frame of the cab. Guys with turnbuckles are used here also. A false frame on the engine support allows for streamlining. The whole was then covered with airplane fabric and nitrate dope applied until the fabric was wind-tight. A final coat of clear varnish added greatly to the appearance.

Sheet iron is used for flooring of the cab, the engine compartment and for streamlining of the rear. Heavy gage tin is used in the engine cowling, which is streamlined as far as possible.

The cab and the engine compartment have a door on each side. A 20-gallon gas tank is securely fastened to the frame with strap iron. The colors of the sled are very pleasing; the dark portions being a Benz gray (a greenish gray), and the light portions a nickle gray.

For the running gear, low bent hickory runners are shoed with ¼-inch spring steel and topped with six-inch steel skiis. The purpose of this ski is to carry the weight of the sled over the top of the snow when the runner breaks through. The axle supports of the runners is built up of welded steel tubing.

The steering device of the front runner uses the front wheel assembly, axle, the rear brake drum of the model "T" Ford, together with a chain and the column and wheel of an old steering wheel. The Ford wheel hub is bolted to the front cross-piece of the frame and the axle of this hub, with its spindle, is mounted to the runner supports by a piece of channel steel—shaped to properly fit the spindle.

Thus, this runner can move up and down and horizontally. The brake drum is welded to the axle. The steering column is mounted through another cross-piece, cotter keys and washers keeping it in place. The center of the chain is bolted to this column. Each end is then wrapped once around the column, and the two ends are bolted to the brake-drum. This device is giving the best of service.

Special care in the design of the rear running gear was exercised to conserve the weight. The axle is Shelby steel tubing 2 in. OD by ¼ in. wall by 7½ feet wide on which two model T front springs are mounted. The center perch has the upper part of another perch welded to it. A truss distributes the stress from the center of the axle.

Over rough terrain this truss is protected by a third ski under the center of the sled. The frame of the snow-boat is mounted to these springs by

two double brackets forged from tool steel.

Ford shock absorbers ease the action of the springs while radius rods of cold-rolled steel on either side of the frame (to the axle) transfer the forward motion of the body to the rear runners. To prevent the rear runners from dropping into a hole, and turning upside-down, a loose chain connects them to the frame of the sled.

The sled is 18 feet long from tip to tip and the rear runners 7½ feet wide. The cab is 55 inches high. The center of gravity is only 59 inches above the ground so that it is practically impossible to tip the machine over. Its weight is approximately 1000 lbs. The main gas tank empties into a small tank just above the carburetor by air-pressure.

For starting, pressure is had from the regular hand-pump and an air-pump on the engine maintains this pressure. Electricity is supplied by a storage battery, and a foot pedal controls the engine throttle.

Spark and gas levers of an old steering gear are used to control the spark of the rear magneto and choke. An oil gage, an air gage, and a temperature gage are mounted on the instrument board, while a dual ignition switch controls the two magnetos of the motor.

To overcome the difficulty of starting this engine in cold weather, an electric heater was placed in the crankcase of the engine and one on each of the intake manifolds. For the crankcase heater, a 750 watt electric stove element was rewound to a smaller diameter, insulated and placed in a ⅝ inch copper tube.

This heater is permanently mounted in the bottom of the crankcase by means of pipe tap tube couplings. A 220 volt electric iron element provided the two elements for the manifold heaters. By reducing the wire in each element, and connecting them in series, just the right amount of heat is obtained. These heaters are strapped to the intake.

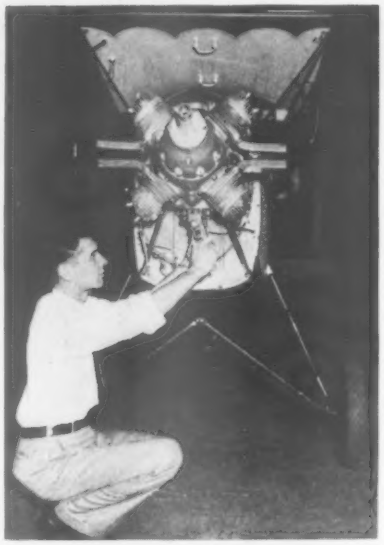
In twelve to fifteen minutes, these heaters warm up the engine for easy starting—even in the coldest weather. To further simplify cold weather starting, a primer feeds both manifolds and a hot spark is fed to the rear magneto through a booster coil.

This snow-boat has sufficient power to travel over bare gravel or ground. It is used for cross-country travel, through the fields, ditches or along the railroad and is seldom used on the roads except for crossing from field to field.

The gas consumption depends upon the condition of the surface over which it travels. Over broken dirty snow, the snow-boat develops a speed of 37 m.p.h. at quarter throttle. On ice it is impossible to park the machine if the engine is running—even at its lowest idling speed.

On a safe stretch of packed snow or ice, the snow-boat very readily develops a speed of 100 m.p.h.

Two-Cycle Engine for Lightplane



Installation of two-cycle engine.

AN UNUSUAL type of lightplane engine has been developed in Chicago by a group of engineers. This is a four-cylinder, air-cooled, two-cycle engine of the radial class, and like other two stroke engines, has no valves.

As a two-stroke cycle engine gives one power impulse every revolution for each cylinder, it will be seen that the new four-cylinder engine is the equivalent of an eight-cylinder four-stroke cycle engine, both giving four power strokes per revolution.

The number of working parts are only a small fraction of the parts required for a four stroke cycle engine, therefore, there is less opportunity for trouble. It is claimed that ordinary automobile gasoline may be used in place of the expensive aviation grade.

The lightplane, to which the engine is shown attached, is said to cruise at 85 miles per hour for 340 miles with 16 gallons of gasoline. The empty weight of the ship is 475 pounds, or 950 pounds when fully loaded. The photograph shows H. McKay Steele, one of the engineers, making a final inspection of the engine.

Please Shut the Door

CLYDE PANGBORN, who flew around the world with Hugh Herndon, had the thrill of his life recently on a flight from Albany to New York City.

While passing over Yonkers, the right hand window of his cabin plane fell out. The wind, whipping through the opening, tore large holes in the side of the fuselage and the under surface of the wing.

By deft maneuvering, Pangborn brought the ship down at Floyd Bennett field. "Lucky that didn't happen over Siberia," was his only comment.

And His Whiskers Still Grow

A REPRESENTATIVE of an oil company in San Francisco, Calif., states that a place of real interest located out his way is at Grass Valley, up in the Sierras. There is an airport here, the first one built in California 'way back in 1907.

He goes on to say that old Charlie Gilmore, who owns the place, designed and built two ships that year. He also started a beard growing with the intention of shaving it off when the ships flew. Well, he still has it. Both ships have bat type wings.

Actually, his designs were quite advanced at the time. The large ship has a four-cylinder engine of that date and swings an 18-foot prop. The fuselage is rounded like a Lockheed and it has a closed cabin. In fact, it is very similar to a Lockheed, although very heavily built.

There are also two landing gears, one being a small one in back in lieu of a tail skid. Light struts run from the wing to the fuselage on each side, reversed from general practice. Gilmore said if he could get it in the air it would be fifty miles an hour faster than the Lockheed—that's plenty of faith. The fabric is the old original and slowly going to pieces.

The other job is a cabin also, with the fuselage two place very much like a Curtiss Robin. At that time most designers were still putting the pilot out in the open on pusher biplanes. These are both tractor cabin monoplanes, which shows considerable foresight. They ought to be in a museum, but he could not be persuaded to part with them.

A British Aerial Camera

AN AERIAL camera of rather unusual design is used by the British R. A. F. for military service. As shown, the observer in the gun turret is taking a shot at a distant scene with the conical cased camera. This casing insures proper protection against the wind stress and is convenient to handle in flight.

Taking photo shots from the turret.

Danger Periods in Aviation

THERE are three danger periods in the flying experience of the amateur pilot, according to the aviation insurance expert of the Royal Aeronautical Society in London, Capt. A. G. Lamplugh.

The first of these is between the 20th and 30th hours of piloting, he declares. It is attributed to errors of the newly-fledged pilot made without a guiding hand on the dual controls.

The next, and most dangerous period, is between the 80th and 120th flying hours. It is then, apparently, that the pilot becomes overconfident, trying stunts, fancy and dead stick landings and the like.

The third peak of accidents comes for the amateur pilots between 500 and 600 hours, and is more difficult to explain. Maj. Lamplugh believes it is another sort of overconfidence which may lead the flier to continue a journey under hazardous weather conditions.

Now, Washing Machines Fly

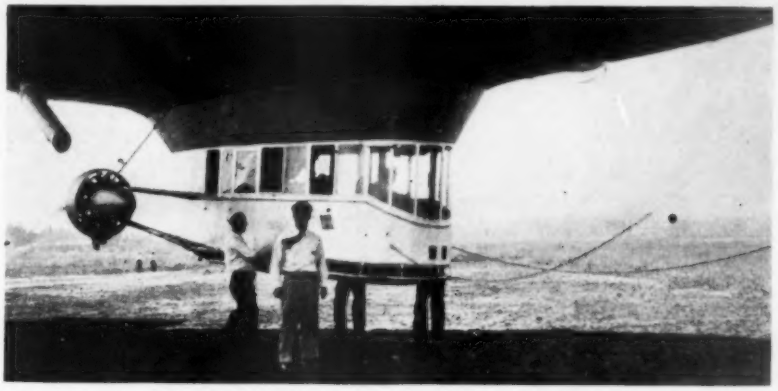
SELLING and delivering washing machines via the air route is a late business development. What is declared to be the most completely equipped privately owned plane ever built, now flies the airways for the Automatic Washer Company. It is daily winning publicity for its owners and is building up good-will that prove a business winner in the years to come. As the plane skims through the air at a speed of 110 miles an hour, President H. L. Ogg handles his correspondence by means of his Ediphone. His secretary operates her typewriter or uses her convenient files.

Then for the leisure hours there are vanity cases, moving picture equipment, a lunch kit and many other conveniences that help to make the modern office of the air highly efficient. All the furniture in this plane is removable, permitting delivery of three crated electric washers. It carries four passengers and pilot with office equipment.

Busy at work in an airplane office. Note the modern office equipment.

Aloft in a Disobedient Blimp

By DOC SCHNURMACHER



A close-up of the Columbia's nacelle and the outboard engine mounting. Note how well the nacelle fits into the envelope above it.

HOWDY, folks! This is Graham McNamee Schnurmacher, broadcasting the battle of the century directly to you over POPULAR AVIATION'S great network from the control cabin of the Goodyear blimp Columbia.

This colossal struggle, between Pilot Roland Hobensack and Old Man Wind, has come somewhat as a surprise to Pilot Hobensack who hails from Gadsden, Alabama, where Old Man Wind isn't as playful as he is over Holmes Airport, Long Island City.

At any rate, folks, the kickoff of this unheralded, unprecedented and spectacular pageant has occurred at 4 p. m., right after the Columbia discharged sight-seeing passengers and sailed aloft on a short test flight.

Roland Hobensack at the controls has just kicked off, folks, and a beautiful punt it is. With relief pilots Frank Trotter and Paul Dixon sitting on the sidelines in the cabin, good old Roland puts the big sausage a thousand feet into the air.

Old Man Wind comes through with a clean tackle from the 30 mile velocity line and the blimp is stationary now, folks—yes, sir, she's anybody's blimp. No, wait a minute, Hobensack calls signals again, puts the gun full on and the blimp sails slowly and majestically off in the direction of the Manhattan Goal Line.

Old Man Wind was taken off his guard that time folks. Yessirree! He let Hobie score. Just shows you what clean living and quick thinking will do.

The goals are reversed and now Hobie is going to try to make the hangar. Old Man Wind has something to say about that—he's a great defensive player.

Once again Hobie kicks off and Old Man Wind nails him on the forty mile velocity line. Hobie can't make the hangar, folks—he just can't, and he's been thrown on the defensive, too.

Hobie just made a triple pass of the controls to Trotter and to Dixon. It's no use, folks. None of his crack teammates can do anything about it. Old Man Wind's line is holding fast and there the old Blimp is hanging stationary in midair over Holmes Field.

And now, before it gets too dark, folks, let's look around the Stadium of the Sky and see some of the distinguished audience watching from the box seats. Sorry I can't get these celebrities to say a few words, but they are flying around too far from the Mike.

Over there, with plenty of altitude, is Police Pilot Van Hagen in a little Fleet. He looks plenty anxious to get into the game, folks, but of course professionals are barred. Flying under him is Paul Whitney in a racing Gee-Bee, one of our most interestingest spectators.

Then there's Bill Cleveland flying Bill Hearst, Jr.'s new Sikorsky and Casey Jones in his blue and red Travelair Sportsman de Luxe. Casey needs a shave, folks. Yessiree, I can see that all the way from here.

Over there is Bill Zelcer in his 300

(*Continued on page* 126)

Rear view of the Columbia, showing fins and control surfaces.

The New Army Planes for 1932

by JOSEPH S. EDGERTON

America's fighting planes are the last word in modern construction and speed. The latest aircraft developments are featured in Uncle Sam's ships for 1932.

THE most formidable aerial fighting planes that this country has ever known, are adaptations of the low-wing racing monoplane design. The new 1932 battle-planes of the Army Air Corps are revolutionary and entirely different than any ships employed to date.

During the past few months, there have been developments in Army fighting plane design which promise utterly to change the character of the country's combat squadrons and to make necessary the rewriting of the theories of aerial tactics.

As a result of discarding the old ideas of fighting plane design, the average speed of the various combat types has been stepped up by nearly 70 miles an hour. Though the biplane was the universally accepted type for Army use during the decade following the World War, the past few months have brought the monoplane into a predominating place among the new designs.

Pursuit planes, for many years considered the backbone of aerial power, are undergoing marked changes. Most important of the changes is the adoption of the two-seater type with guns both fore-and-aft. Twenty-five two-seater biplane pursuit ships have been contracted for, and will form the nucleus of an entirely new type of combat unit which probably will go into action for the first time during the Spring maneuvers of 1932.

The Air Corps has just ordered five low-wing two-seater monoplane pursuit planes, said to be somewhat similar in appearance to the plane in which Col. Charles A. Lindbergh made his recent visit to the Orient. These planes, however, will be powered with Prestone-cooled engines stepped up to the high compression ratio of 7.8 to 1 and develop a normal output rating of 660 h.p. at 2,400 revolutions per minute, sea level.

These planes, expected to develop a speed of approximately 220 miles per hour, will go into service test with combat units, but they are being developed with the greatest possible secrecy. No pictures of them have been made public and performance figures are carefully guarded.

What is characterized as the most terrible offensive weapon ever devised for use against ground troops, is the new low-wing type of attack plane developed by the Army Air Corps after extensive secret tests. Thirteen of these planes have been ordered for service use. This ship is shown by the accompanying Fig. 1.

At speeds in excess of 180 miles per hour, these planes fly in valleys, behind hills or under the cover of forests to take their ground targets by surprise. In the few seconds which comprise an attack, they are able to envelope their targets in an almost unbelievable fury of lashing metal. Each plane carries six machine guns and fragmentation or poison-gas bombs.

A squadron of 18 of these planes, during the period of an attack, can develop the equivalent of the machine gun and artillery fire of a full infantry division of 30,000 men. This terrific fire can be concentrated on a target only a few yards in diameter.

Twin-motored long-range reconnaissance planes, which depend upon great speed and effective defense armament to take them miles behind enemy lines, observe enemy activities outside the combat areas. They have a vital bearing on the outcome of battles that are being fought. Five planes of this type have been ordered, pictures of which will be found on page 81, December issue, POPULAR AVIATION.

All nations are now vigorously competing for the domination of the air. Drastic changes in design are taking place overnight with improvements in speed and maneuvering ability that are almost beyond belief.

The changes, however, are not simply mechanical. They go further than that. They affect the entire technique of aerial combat.

A number of twin-motored light bombardment monoplanes, similar to the long-range reconnaissance planes, also have been ordered from two different manufacturers. They are expected to be the most effective bombers ever produced. Strongly armed, they will be able to withstand the assault of pursuit planes. They will develop such speeds that the fastest pursuit squadrons now in existence could hope for no more than a single hurried attack on them before they passed out of range.

Observation planes, which have for years averaged speeds little better than 100 miles per hour, are giving way to planes cruising at 165 miles per hour or better.

The racing plane influence extends to all types of the new Army planes. Transports are not excepted from the new demand for great speed, for the modern Army transport plane is capable of holding its own in the fastest company. Several of the new types cruise at better than 180 miles per hour.

The series of photographs accompanying this article show graphically the startling changes which are being made in the Army's fighting plane squadrons. Some of these pictures never have been published previously.

Whether the monoplane will actually prove as adaptable to military service as the biplane is a question which actual war experience alone can prove. There are a lot of theories that look pretty on paper but which do not work out so well under actual service conditions. This was proved conclusively during the last war.

Then the rapid development of anti-aircraft guns may call for still more radical changes in the near future, for under recent intensive development, anti-aircraft fire is proving more and more formidable.

For a squadron to operate in safety, even under present conditions, would require full maneuverable flight at an altitude of about 30,000 feet. Whether the present 1932 models can dodge the Archie fire as effectively when 6 miles above the earth as they do at present, will always be a question until the trial is finally made under service conditions.

As recently explained by a War Department official, formation flights will rule in future wars. The day of the "ace" and his single-seated combat ship has passed. This is reflected in the general adoption of the two seated fighter shown in the accompanying photograph.

It is quite apparent that the Army Air Corps still adheres to the liquid-cooled engine to a great extent. In fact, this stand has always been noticeable in the Army ships, while the Navy tends more toward the air-cooled type. The employment of twin-engine ships of the high speed type with engines located in the wings marks a new departure, however.

While streamlining of external structural parts is a marked feature with some of the ships shown here, yet there are one or two examples where this has apparently been ignored, at least so far as the landing gear is concerned. The interplane bracing of the biplanes has undergone little refinement.

XUM

1932 U. S. Army Air Corps Designs

Eight More Photographs for Your Album

Photographs by Courtesy U. S. Army Corps

Fig. 1. The present Curtiss Attack plane, type A-3, now in service, is shown in contrast to the new attack plane (right). It will be seen that the biplane type has given way to the Monoplane in this class. Little attempt at streamlining here.

Fig. 2. The new Curtiss Attack plane. It has an approximate speed of 186 m.p.h. and is powered with a 600 h.p. Prestone cooled engine. It carries six machine guns and a bomb. Note the covered cockpit and the pants.

Fig. 3. Three-quarter view (from rear) of the new two-seater Pursuit or fighting plane. In this case, the biplane still holds its position. It carries two men and four guns and is faster and more maneuverable than the old single seaters.

Fig. 4. Front view of the same pursuit ship, showing that no attempt has been made at streamlining the landing gear, and the "N" interplane bracing has not been changed. The span and cord of the lower wing are much less than the upper.

Fig. 5. This is an army transport ship. It is a cross between a racer and a Lockheed transport. It has a round section fuselage and is equipped with an air-cooled engine in contrast to the attack planes and fighters.

Fig. 6. This is another Army Air Corps transport ship which differs only in detail from (5). Both this ship and (5) have a speed of well over 200 m.p.h., and both are equipped with air-cooled engines.

Fig. 7. This is an experimental long range reconnaissance type plane. It is equipped with two wing-mounted engines and the forward vision and fire zone is therefore unobstructed. This will result in new observation tactics and is a promising type.

Fig. 8. A new combat observation type capable of speeds better than 180 m.p.h. Once more we get back to the biplane, which seems to be a favorite for the majority of combat type ships. In this case, the wheels are streamlined.

The N. A. B. A. Lightplane Is Interesting

A low cut door in the N. A. B. A. makes the seats easily accessible. Also note that the tail is carried off the ground.

THIS unique two-place lightplane, the product of the National Aircraft Builders' Association, is a high-wing monoplane with an exceptionally low fuselage. Unlike the majority of lightplanes, it is carried on a three wheel landing gear with the rear end of the fuselage clear of the ground. It is claimed that it will not ground loop for the reason that the two main wheels are back of the center of gravity while the third front wheel is steered with the rudder pedals.

It is provided with a Peter's converted Lawrance engine of the two-cylinder opposed type, which develops 38 h.p. at 2,000 r.p.m. It is said that this plant gives the ship a top speed of 80 m.p.h. and a cruising speed of 65 m.p.h.

NABA SPECIFICATIONS

Span	36 ft.
Wing area	201 sq. ft.
Length, overall	23 ft.
Height, overall	6 ft., 6 in.
Weight, empty	575 lbs.
Weight, loaded	975 lbs.
Power loading	25.75 lbs./h.p.

It can be built from blueprints sold by the association and the materials can also be had from the same source.

Plays Fireman in Plane

A REMARKABLE record for sighting fires from an airplane has been established by Lewis Gravis of Chicago. In the past three years this young pilot has reported five fires, while piloting a night mail plane.

Gravis recently sighted his fifth blaze while flying over Kirksville, Mo. Seeing the roof of a house ablaze, the pilot sent his Boeing plane into a dive, with the motor wide open.

The roar awakened the inhabitants, who ran from the house to fight the flames. Pilot Gravis has given the alarm at each of the fires by diving with his plane.

A Tin Air Sock

A NEW kind of "air sock," made of tin, has been perfected and is now in use at several airports.

An "air sock" is installed on each landing field and is used to register the wind direction for incoming flyers. The regulation sock is six feet long with a throat measuring two feet across.

The outstanding advantage of the tin indicator over the usual type of cloth "sock" lies in its durability. The cloth signals frequently whip themselves to shreds and become useless. The new device will be most valuable to emergency landing fields since it will not require frequent replacements.

Buffalo Air Mail in 1870

BUFFALO, N. Y., had air mail but no airplanes in 1870, it has been discovered. Not only that, the first air mail stamps in existence were put in use on that memorable Fourth of July when Prof. King came to town with his free balloon.

Bearing the professor, two intrepid newspapermen and a city alderman, together with several letters, the balloon soared from Buffalo to Newfane, N. Y., a distance of about 35 miles. Here the letters were dropped to a gaping group of spectators and duly delivered to the persons to whom they were addressed.

Radio Reduces Hazards

THE problem of preventing collisions between airplanes in flight, under conditions of poor visibility, is rapidly becoming of importance. Consequently a radio device that will give an automatic warning to a pilot of the presence and position of another airplane within a radius of about three miles is being sought by the aeronautics branch of the Department of Commerce.

When flying on a radio beacon course, danger of collision occurs between airplanes flying on the same route but in opposite directions and also between planes flying on different courses which intersect at an airport.

Rockwell Field to be Abandoned

ROCKWELL Field, one of the historic spots in American aviation, will soon be abandoned by the War Department. The closing of this famous flying field, near San Diego, is in accordance with the government's present plan to reduce expenses.

After its abandonment by the Army, it will be turned over to the Navy, but it is believed that they will also discard it. Upon the closing of this early landmark, the personnel and planes will be transferred to March Field at Riverside.

In November, Rockwell Field celebrated its nineteenth anniversary. Founded in 1912 by a hardy group of flying pioneers, it has been the scene of many stirring events in aviation history. The War Department credits it with a record for the greatest number of first successfully completed aerial stunts. The list includes:

World's first bombing experiments, April, 1914.

First parachute leap, July 4, 1915.

First plane-to-ground radio communication, July, 1916.

First massed flight formation ever to take the air, November, 1918.

The first plane to be flown at night was piloted here by Major I. C. Maculey.

Rockwell Field was also the scene of the first loop-to-loop ever completed in America. This, now common stunt, was introduced by the late Lincoln Beachey.

And so, with a glorious record of flying pioneers and plane development, this famous field will become another landmark of aviation.

Leo Stevens Still At It

BACK in the gay 90's he was called "Prince Leo, the Boy Aeronaut." For nearly 40 years he has been identified with ballooning and aviation in the United States. Now he is getting along in years, but he hopes to make one more contribution to aviation before he hangs up his flying togs.

The man is Leo Stevens, of Cooperstown, N. Y. At present he is working on the construction of a fool-proof parachute. His parachute, he says, will open unfailingly even if the aviator's hands "freeze," due to air pressure; it will be lighter than any 'chute now in use; it will be made of cheaper and stronger material than silk, and it will float indefinitely if the flier drops into a body of water.

Parachutes always have been Stevens' hobby. He was the first man ever to devise and use one. This 'chute was fastened to the side of a balloon basket, the suspension cord breaking and opening the 'chute as the airman went over the side.

In 1902, Stevens predicted trans-oceanic dirigible flights, and he and his "dream ship" were subjects of many humorous cartoons of that day.

Typical Ground School Course

SO MANY prospective aviation students have written to us, asking information concerning the subjects taught in the ground course, the time required and the distribution of this time, that we are printing the following schedule.

This schedule, which applies to both the flying and mechanic's courses, has been approved by the U. S. Department of Commerce Aeronautics Branch, and lists the subjects as they are actually taught by a prominent flying school. It will be noted that both the pilot's and mechanic's courses are divided into three grades.

FLYING COURSES
(Lecture Room Work)

Subjects	Private	Limited Commercial	Transport
Navigation	0	8	24
Airplanes	20	20	20
Engines	12	12	16
Meteorology	0	8	16
Air Commerce Regulations	10	10	10
Parachutes	3	3	3
Instruments	0	7	7
Radio	0	3	3
Total Lecture Hours	45	71	99

(Shop Practice)

Subjects	Private	Limited Commercial	Transport
Wood and Finishing	0	25	120
Engines and Instruments	0	29	140
Total Shop Hours	0	54	260
Total Hours Lecture and Shop	45	125	359

MECHANIC'S COURSES
(Lecture Room Work)

Subjects	Elementary	Advanced	Complete
Airplanes	20	20	20
Engines	12	16	16
Air Commerce Regulations	10	10	10
Total Lecture Hours	42	46	46

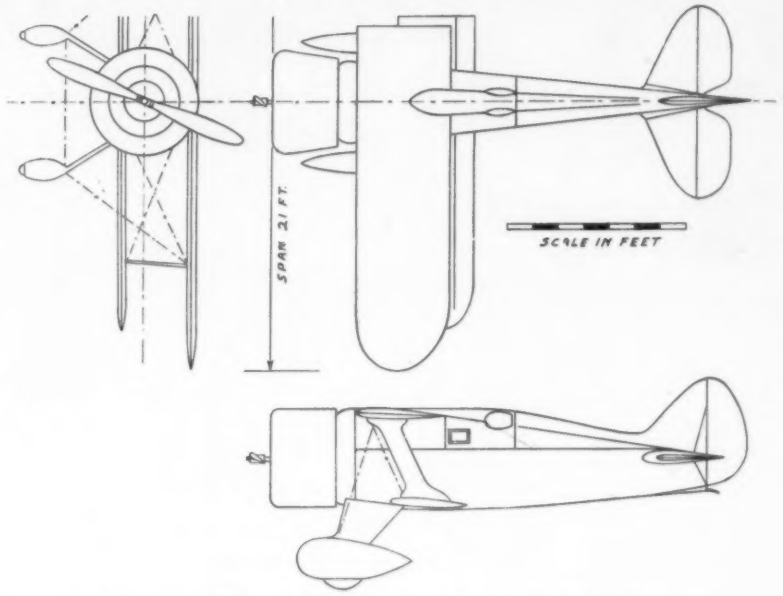
(Shop Practice)

Subjects	Elementary	Advanced	Complete
Metal	50	110	160
Wood and Finishing	65	150	245
Engines and Instruments	75	176	255
Total Shop Hours	190	436	660
Total Hours Lecture and Shop	232	482	706

Panama Scraps Navy for an Air Force

THE Navy of the Republic of Panama, which consisted of a single gunboat used for the enforcement of the revenue laws, is no more. This craft has been decommissioned and an air force is established. Captain C. K. Travis, who has since been one of the "crack" pilots of the Pan-American Grace lines, has been engaged as Chief Pilot and was sent to the States to bring back the first of three planes purchased by the Republic of Panama.

Scale Drawings for the Laird Super-Solution



To scale off the above drawing, use the "foot-rule" marked "scale." Each division represents one foot.

"THE Super-Solution" in design is practically the same thing as the "Solution." It is a single-strut biplane with the wings flush at top and bottom of the fuselage and it has a particularly clean appearance when viewed from the front.

As will be seen from the drawings, the wings have a very pronounced stagger with the lower wing cord about half that of the upper wing.

The engine is a supercharged Pratt & Whitney "Wasp Junior" which develops 510 h.p. at 2400 r.p.m. The Super-Solution first competed in the Bendix Trophy Race, a free-for-all speed race from Burbank, Calif., to Cleveland, Ohio, a distance of 2,100 miles. It won this event at an average speed of 223 m.p.h. Recently, Maj. Doolittle has flown the ship from Ottawa, Canada, to Mexico City, a distance of 2,500 miles in 11¾ hours flying time. The following are the general specifications:

Specifications

Span (top) .....21 ft., 6 in.
Span (bottom)..19 ft., 5½ in.
Length .....19 ft., 6 in.
Wing area .....112 sq. ft.
Weight empty .....1,580 lbs.

As seen from the side, the body is short and chunky with the pilot's visor-line continued back to the elevator. The cockpit is entirely enclosed by a transparent wind screen.

The Air Mail Cover Collection Hobby

"OKAY, jerk 'em."

The chocks were torn away and the powerful Lockheed started off over the ground in a long racing taxi. Back came the stick, the plane jumped for the heights in a fast zoom and headed west on the inaugural flight of 24 hour, coast-to-coast air mail service.

For the purpose of marking this important flight, the Post Office Department applied a special marking to each envelope and card on the plane. Thousands of these were sent in by air minded collectors of air mail covers, anxious to record the epoch making history of the development of mail transport by airplanes.

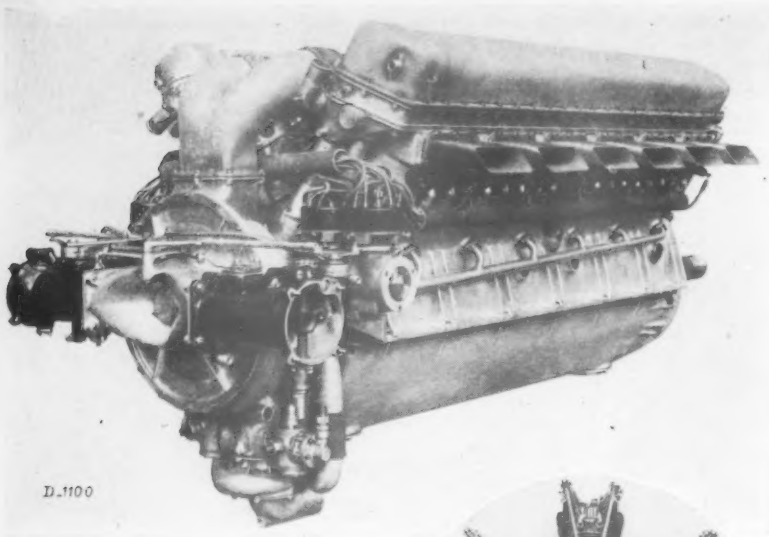
"Air Mail Covers" are envelopes and cards mailed by air, each marked with a seal of distinction known as a "cachet." The latter is a general term applied to a rubber-stamped or printed impression, placed on the face of the mail, containing data of use and other explanatory descriptions. These printed impressions commemorate inaugural flights and other important aeronautical events.

The various "cachets" are classified according to their origin. The Official cachet, placed on all mail carried on first flights, is applied by the Postmaster with permission granted by the Post Office Department.

The Un-Official cachet is applied to all other covers by the Postmaster without authorized permission or by the Chamber of Commerce, American Legion, or other civic organizations. The Private cachet is issued by an unauthorized individual. Covers bearing these cachets are not popular.

(*Continued on page* 131)

Lorraine Engines Among Leaders in France

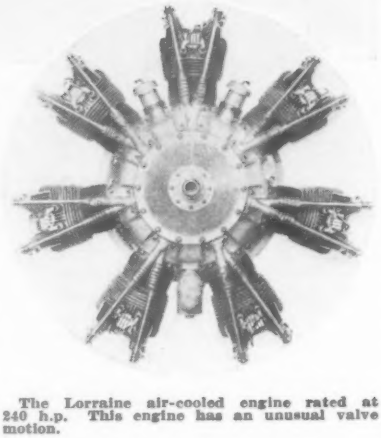


The Lorraine liquid-cooled, 1,000 h.p. "Vee" engine (D-1100).

MUCH has been said recently of the French Lorraine engines which have shown remarkable performance in European competitions. A Lorraine engine was a winner in the Michelin trophy race and several other important events of 1931.

Now, the manufacturers of the Lorraine engines make both air and liquid cooled engines, two examples of which are illustrated here. The most important of the line is the liquid-cooled twelve-cylinder "Vee" type engine which is rated at 1,000 horsepower and is known as the D-1100. Study of the photograph shows that all of the moving parts, including the valve mechanism, is entirely enclosed in oil and dust tight casings.

At the rear of the engine (left in photograph) will be seen the supercharger casing mounted on the end of the crankcase, with the two carbureting mixer venturis connected to the center of the supercharger casing. From the fact that ignition distributers are shown (four of them), it is evident that this engine employs battery ignition instead of magnetos.



The Lorraine air-cooled engine rated at 240 h.p. This engine has an unusual valve motion.

A glance at the seven cylinder air-cooled radial Lorraine engine shows that it is more or less of the conventional type. As with many European radials, the exhaust and inlet push-rods converge to a common point on the cam circle. This air-cooled Lorraine is rated at 240 horsepower and has seen extensive service in the various French events.

To Cover Globe in 80 Minutes

AROUND the world in 90 minutes is the modest goal Germany's rocket enthusiasts have set for themselves as a sort of preliminary to journeys to the moon and planets.

As yet no passenger-carrying rocket, even for earthly distances, has been demonstrated in Berlin, but Reinhold Tiling, inventor of the sailplane rocket recently shown at Osnabrueck, is so confident of its safety and practicality that he plans to build one big enough to carry himself aloft before the end of the year. Tiling's rocket goes up like a bullet, then spreads wings to descend like a sailplane.

Pilots Denied Black Canon

SPEAKING of safety first in aviation, the United States has just issued an order forbidding pilots from flying their planes down in the Black canyon, near the Hoover dam site on the Colorado river.

The canyon is about 1,200 feet deep, and air regulations allow planes to fly within 500 feet of the ground, but Uncle Sam has ruled in this case that the 500 feet must be estimated from the top, instead of the bottom of the canyon. Pilots have been doing a thriving business carrying sight seers into the canyon, despite the blasting operations which are going on constantly.

New Formation Flying System

FOG has always been a menace to navigation, but the recent training experiences of the Army fliers at Kelly Field indicate that it will not halt air maneuvers in future warfare.

Instead, fighting planes flying in massed formation will plunge into the thickest of clouds or fogs, following their squadron leader, whose plane is equipped for blind flying.

This mode of flying has become one of the most important studies in the cadet's training at the Army Flying School. Numerous tests have convinced the instructors that the student aviator can fly through the fog and clouds, which shut out the ground and all landmarks, by merely using the leader's plane as a horizon.

But several instances have shown that if the student once loses sight of the leading plane he is apt to go into a spin, and unless he is acquainted with the use of blind flying instruments, he will inevitably crash.

Blind flight training has become almost indispensable to the Army flyer, and standard equipment is now being installed on all combat planes. Each student now takes, as part of his regular training, eight hours of blind flying in the "hooded cockpit." This is constructed in such a manner that it shuts off all points of orientation except the instruments on the panel in front of the pilot's eyes.

The officers at Kelly Field declare that the training has been made compulsory, not only as a means of protecting the pilot and planes but for increasing the fighting power of aircraft in time of war.

It was through the efforts of Major William Ocker, Army Air Corps, that the blind flying program was introduced. The Major is also the inventor of an improved blind flight instrument now undergoing a long series of tests.

Lands Burning Plane

LIEUT. E. H. BOBBITT, Air Corps Reserve, Selfridge Field, Mich., brought his P-6 back into Selfridge Field with a great deal more haste than usually characterizes the landings of new graduates of the Air Corps

Shortly following his take-off, and while attempting a slow roll at about 4,000 feet, his carburetor flooded and the side of the ship burst into flames.

Evidently an initiation into the Caterpillar Club did not appeal to Lieut. Bobbitt, for he didn't jump. He did get his plane down before either of the wings had burnt off.

According to observers on the ground and in the air, however, he really did not give the fire a chance, for the speed with which he got his fiery chariot back on terra firma was a revelation to all. Even the manufacturers might be interested in having the exact figures on the time it took him to descend from the aforesaid altitude and empty the pilot's cockpit.

Flutterings of an Early Birdling

by CHARLES F. WILLARD

The tribulations of the early exhibition flyers who lived and thrived on mechanical trouble

Charles F. Willard, the author, is one of the very earliest of American air men, and was the first man to be taught by Curtiss. He also participated in many of the first aeronautic and radio experiments. It is with great pleasure that we introduce Mr. Willard to our readers.

Charles F. Willard in the early Curtiss type, the "Banshee," built by him in 1910. Lieut. Fickel (right) is going up for target practice.

MANY were the trials, struggles and hard experiences of that little group of pioneers who first explored the mysteries of the upper air. So little was known of the basic principles underlying powered flight that the only road to accomplishment necessarily meant direct and original experiment. Each flight, in the very early days of aviation, was truly a trip into the unknown.

With these crude, frail, under-powered airplanes we met with experiences fully as dangerous and thrilling as those encountered in after years by that bevy of wild larks—the war birds. I am referring to the years 1909, 1910 and 1911, when it was a distinct accomplishment to build an airplane that would fly at all—let alone fly efficiently.

These early ships would seem unbelievably light and frail to the aviator of today, and I very much doubt whether any modern pilot could be induced to fly one of them at all. The lightness and frailty of the 1909 airplane was indirectly due to the feeble and unreliable aviation engines of that time, the conditions demanding that the ship be built down within the capacity of the available engines rather than to be built up to any standard of performance.

It was truly necessary to scratch off the last ounce from the structure so that the midget engines could lift it off the ground, and this extreme lightness, of course, meant structural weakness to an extent that can hardly be appreciated today.

A structural strength test in those days was sweet and simple. I seated myself in the ship while a mechanic at either wing-tip lifted the front of the machine off the ground. If this was successful, then a similar test of the rear wing beam followed. If nothing broke or sprung out of shape during this test, then the job was O. K.'d and we were ready for flight!

So weak and feeble were the engines, and so ineffective were the "wing-sections" of that day, that it was often necessary for me to drain all of the gasoline out of the tank, with the exception of a gallon or so, before the ship would be able to lift off the ground at all. As a last resort, it was also often necessary for me to remove my leather coat before she was light enough to take-off, all of which is coming mighty close to the edge of things.

Very frequently I would be called on the carpet by the spectators of a flight or by the managers of the meet, who demanded bigger and better flights. They would call with disgust, "Why don't you go higher," but the only possible answer was, "I can't." I had already given them all I had—and there wasn't any more to give.

* * *

SO far as I am concerned, it makes no difference whether I am sent plunging down to earth with a broken wing or crippled tail, or whether I am shot down by the enemy. In either case the experience is just as dangerous and unnerving. I can tell you this first hand because I have experienced precipitous descents from all these causes.

Long before the airplane had received its baptism of fire in any war, I was shot down by a person who evidently considered the affair in the light of a sporting event. To him, this was just one plumb good shot! To the pilot of the present day, this would be unbelievable, but to me it was simply one of those incidents that were so frequently encountered in the early days.

I had been flying along serenely, about 200 feet above the ground, sitting out in front of the ship with one foot swinging freely in the air. Then, without a warning, came a sudden jolt as the slug from a nearby gun smashed through the propeller, ripping off a large fragment from one blade. Subsequent investigation showed that a man walking along the road under me had let me pass by and then took a pot shot at me from the rear—just for luck.

ANOTHER experience, nearly as alarming, was had during the first airplane radio tests that I conducted for Dr. Lee DeForest in 1910. The purpose of the tests was to determine whether it was possible to establish radio communication between the ground and a plane in flight.

During the tests, held in San Francisco during an air-meet, a prolonged rain set in. It continued to rain for ten days in tropical style until the center of the race-track was transformed into a lake with a little island of dry ground in the center. Several queer looking packages were fastened to the plane by the radio people, and the sending key was fastened to my leg, for there was no other place to put it where it could be reached.

After the installation, I was shown how to dot and dash an "SOS" signal, or some such thing, with the key, while the radio men on the ground were to try to receive my signal. This seemed simple enough, so I took-off and started the test. After three circuits of the field, I pounded away at the key in such intervals as the controls would permit, and all went well—for a time.

Then the fun began. There was a crash from behind and then a peculiar noise as if something was striking the propeller. I could see nothing wrong from my perch-like seat out in front, so I made all haste to land—but where? The little island offered the only landing place, and some help was necessary from the propeller even to reach this point.

Very quickly there was another burst of noise from the rear. Was it the bamboo outriggers? If so, then the tail would soon go and there would be only one answer to that. Breathless

moments that seemed an age before the engine could be stopped—and then a landing on the little island.

A glance showed that one of the boxes of radio tricks contained, among other things, a condenser composed of glass plates. The vibration had caused the glass plates to sift out—one by one—but luck was on my side for once, since they contacted in such a way that little damage was done to the propeller. Such is the story of the first attempt ever made to send a radio message from an airplane.

* * *

WHILE flying a solo exhibition in a middle western town, there occurred one of the most frightful and painful incidents in my flying career.

I was approaching the improvised flying field at an altitude of about two hundred and fifty feet, contemplating the moment to cut the engine for a glide to a landing which was to conclude a three-day exhibition.

Then, suddenly, came that sound which is most terrible to the ears of a pilot, a loud crash in mid air and the crankshaft twisted off in the rear bearing. The propeller chopped off the control wires and also three of the bamboo outriggers which held the tail surfaces.

Instantly the machine lurched into the wildest sort of gyrations. The elevator, being in front, was uninjured, as were the ailerons, and with these remaining controls I began to real fight for life. First the tail took command of the machine—then I would fight for it. A couple of wild dives were straightened out, while with the ailerons I managed to keep the machine right side up. We were hustling down in a dazing zig-zag fashion.

Nearing the ground, I drew my foot up onto a seat brace, ready for a jump when the front wheel hit the ground. The motors, none too securely fastened behind the pilot, had a habit of jumping out and landing on the pilot's back when a nose crash occurred.

When the wheel hit, I shoved off to one side with a mighty effort. The front edge of the upper wing caught me on the shoulder and slammed my face down into the dirt. The motor shot past, clipped the sleeve of my coat, and buried itself in the ground beside me.

When the wreck was lifted off my back I came to, stood up, took a step forward and glided right off into a deep black nowhere again. Someone found a wheelbarrow, into which they loaded me for a ride to see the doctor.

I was rather used up for a few days, and even to this day there are certain weather conditions which cause a couple of broken ribs to remind me of that little affair.

It is strange how fast the human mind can work when one is face to face with the Reaper. I thought of more unfinished business during the few seconds of that mad descent than could be mentioned in an hour or finished in a month.

This incident, painful as it was, nevertheless returned some satisfaction to those interested in the show. To protect the flying field, the committee wished to close a county road which bordered the field on one side.

With but one exception, the property owners granted the request. That one owner paid in potatoes for his lack of co-operation, for my wild landing took place in that person's potato patch. Imagine his crop after several hundred people had stampeded through it to get a close-up of my misfortune!

* * *

TO start on an exhibition flight, knowing that the chances are a hundred to one that it will terminate in a crash, does not seem a sane thing to do. Yet I once chose to try such a flight.

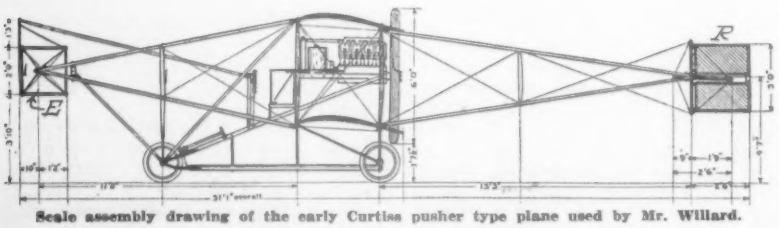
Again, a solo exhibition—this time in Oklahoma. The majority of the spectators were the roughest individuals that I have ever encountered. They had actually pushed down several hundred feet of board fence in a stampede to crash the gate.

Our ground aneomometer registered wind in gusts of thirty miles an hour. This meant that at a few feet above the ground it was suicide weather for the little pusher-type plane I was to fly.

While I was talking to one of the managers of the show, two rough individuals slouched up to us, "Are you the party who is supposed to fly that thing?" inquired one of the pair. I told him that I was. "Well, me and my pal has guns that will shoot about 500 feet, and if you don't fly soon and high, you might get hit," he said.

That pair were just tough and drunk enough to make it seem possible that they might mean it—at least one of the local promoters believed it. In a state of alarm, he inquired if I was going to fly. I told him that I would in a little while, but in his excitement

(*Continued on page* 120)



Scale assembly drawing of the early Curtiss pusher type plane used by Mr. Willard.

Flies With an Automatic Ship

G. WILBUR CORNELIUS is ambitious. He is about to attempt a forty day endurance flight all by himself. Besides being an aviator, Mr. Cornelius is also an inventor and has designed the new type plane in which he is to make his endurance flight.

This machine is novel in the fact that it has free moving wings and automatic flying controls.

Cornelius made a flight from Los Angeles, Calif., recently, without touching the controls. Before making his endurance test, he intends to install a radio and refrigerator and will have a bell to waken him if the machinery is out of order.

The photograph above shows the peculiar jointed center cell which permits the wings to adjust themselves to flight conditions.

He's the Senior Pilot of U.S.A.

HAMILTON LEE is the senior air-mail pilot of the world. His record of one and one-quarter million miles in the air without a serious crash awarding him that title. None of his contemporaries in active flying today can anywhere nearly match Lee's almost 15,000 hours in the air. Theoretically, Lee has flown three round trips to the moon, and is now thousands of miles away from the earth on the going half of his fourth trip.

Actually, he is very busy shuttling tri-motor passenger ships and single-motored mail planes over the line between Omaha and Chicago. Lee is about 36 years old and was a veteran of the air when the United States went to war in 1917. He wanted to go to France, but was considered too valuable as a teacher and was therefore kept at instruction work in the United States.

A Lot of Gasoline

AIRPLANE companies operating on regular schedules are using 20,000,000 gallons of gasoline and 650,000 gallons of oil a year, approximately a 33 1/3 per cent increase over last year.

The War Against Smuggling

By K. M. PAINTER

Pursuing smugglers and rum-runners, saving lives at sea, and stopping filibuster. It sounds like a movie,—but it is the everyday job of the Coast Guard Air Service.

IT was Captain B. M. Chiswell of the Coast Guard who, while commanding the old "Onandago," at Norfolk, Virginia, first became interested in the use of aircraft for the purpose of locating derelicts and searching for disabled vessels.

The Curtiss Airplane Company lent planes and pilots for the experiment, and it was proved conclusively that an aviator could search vast areas quickly, thoroughly, and economically.

Lieutenant Leonard M. Melka, on one of his first patrol flights from Gloucester, sighted between eighteen and twenty ships which appeared to be laden with contraband. Inevitably, the value of the air-patrol in apprehending rum-smugglers was recognized.

Soon radios were added to every plane, so that the nearest cutter could be notified of suspicious cargoes. Even the rum-runners, who had adopted the comfortable habit of having their ships lie 25 miles off-shore, and there unloading them into small, fast boats, were not safe.

Pilots of the Coast Guard, who were responsible for breaking up the famous "Rum Row," were daily treated to an amusing little comedy that might be entitled: "The Decoys that Failed." Prosperous rum-runners thought nothing of sending out three speed boats together, to collect the rum and bring it shoreward. One, following after the other two of the boats, and innocent of smuggling intentions, would flirt with the Coast Guard cutters, passing them by with sufficient speed to look suspicious.

After both cutters had taken up the chase, and were busily engaged with the decoys, a third speed boat rushed madly for the rum ship, and within five minutes, had received the bags and cargo nets. It then turned toward shore after dumping stores on the rum-ship in exchange.

DURING this time, the decoy boats had allowed themselves to be taken, but when inspection proved there was no contraband on them, the patrol allowed them to pass.

A boat load of confiscated liquor in sacks.

This little play, however, was doomed with the advent of air patrols. From the advantageous look-out afforded by the planes, pilots were able to check-up on every move and communicate their findings to a cutter. The cutter then rushed to the chase in time to prevent the runners from landing their cargo on American shores.

Let us take at random, a morning's activities as chronicled in the log kept by Lieutenant Melka when he was flying from the Coast Guard station at Fort Lauderdale, Florida. Before daybreak he took off, intending to cover the lower end of Biscayne Bay before daylight broke.

When he was off James Creek, he sighted a cabin cruiser power boat with no outward signs of contraband, but riding unnecessarily low in the water. He flew close and waved his hand, signalling the boat to stop. The signal was ignored, and immediately his suspicions were strengthened. If the boat were not breaking the law, she would have no fear of stopping for examination. He therefore believed that he had come upon a rum-ship.

After the cutter had reached the rum-ship and had taken control, the pilot and his crew of observer and radioman, took-off and headed southward along the Keys to Barnes Sound.

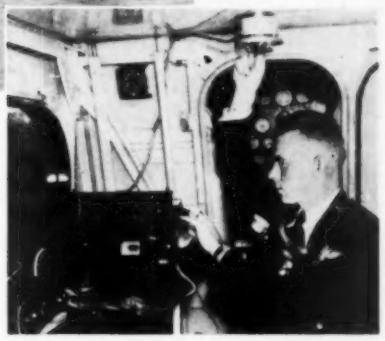
Just off Snapper Creek, the observer sighted what appeared to be sacks of liquor. The plane was landed and taxied to an advantageous position from which the observer and radioman dived overboard and discovered a cache of 21 sacks of assorted liquors and six sacks of beer. This was reported by radio and subsequently picked up by a Coast Guard vessel.

One morning, Lieutenant Anderson —another Coast Guard pilot—was flying abreast of Cutler's Beach when he sighted a motorboat pulling away from a large skiff moored about four miles south. The plane swooped down near the skiff, which was loaded with sacks resembling those in which rum is usually carried, and signalled the motor boat to stop. It continued on its way southward.

A Coast Guard ship taking off, ready for adventure. Its speed is far superior to that of other water-craft.

+ + +

A glimpse of the radio transmitter by which contact is made with cutters.



Deciding that the skiff would be unable to get away, Lieutenant Anderson took up the chase of the motorboat and overtook it. Displaying the Coast Guard Ensign, he again gave the order to stop. This time the command was obeyed, and the observer boarded the boat which Lieutenant Anderson kept under cover with his machine gun. Sixty-six sacks of liquor were discovered.

And right here seems an excellent place to mention the great stress laid on the study of navigation in the Coast Guard air service. It is vitally essential that the planes be able to give accurate bearings to the cutters which are cooperating. The above instance of capture, and subsequent direction of a cutter to the scene of action serves as an illustration.

Consider how this accuracy is demanded when a vessel in distress has been sighted and only immediate assistance will save the lives of those aboard. And to this end, each of the five new ships supplied to the Coast Guard have radio sets which cost $8,000 each—designed by the Service and the most complete ever installed.

Through these radio sets, communication is made possible with other planes, shore stations, naval and merchant ships. The direction finders are remarkable in the fact that they permit the plane to run up on any transmitter beam.

The observer in the plane trained a machine gun ahead of the boat and fired several shots across her bow. The boat stopped, Lieutenant Melka then brought his plane down, taxied to

within twenty feet of the ship and inflated his rubber life-boat—part of every patrol plane's equipment.

The radioman remained in the plane's cockpit, and both the pilot and observer rowed to the suspected ship, which proved to have a hundred and sixty-six sacks of assorted liquors and beer hidden under tarpaulins on the deck and inside the cabin.

THE boat of course, had no manifests and therefore the two men aboard were placed under arrest and left in charge of the Coast Guard observer. Then, Ensign Melka took off in his plane to see if he could locate a patrol boat in the vicinity. Seeing none at hand, he radioed details of the capture to the Coast Guard base and soon a picket boat was heading for the scene of action.

Needless to say, the Coast Guard planes are not always successful, but rum-running has ceased to be a profitable undertaking. The masses have decided that "A Coast Guard plane'll get you if you don't watch out!"

A few weeks ago, Lieutenant Anderson came upon a rum-runner who, as yet, doesn't believe in the slogan. It was shortly after eight in the evening when he sighted a rum-ship with a speed-boat alongside, and another speed-boat headed off to the southwestward. The second speed-boat had not yet made contact and continued her course to the eastward.

As the plane passed over her, the rum-ship got underway, but not before Lieutenant Anderson saw that her deck was loaded with contraband. And, here is the new ruse adopted by rum-runners. Each time the plane circled close to the rum-ship or the speed-boats, the crews held tarpaulin over the numbers!

Since the sea was too rough to make effective maneuvering practicable, and darkness was setting in, Lieutenant Anderson was forced to fly back to his hangar admitting, for once, that he had been outwitted.

But all smugglers are not rum-smugglers. Lieutenant Edge, who flies from the Cape May station, will attest to this. Quite recently he was instrumental in routing the contact vessel of a filibustering expedition that was attempting to transmit guns and ammunition to Cuba.

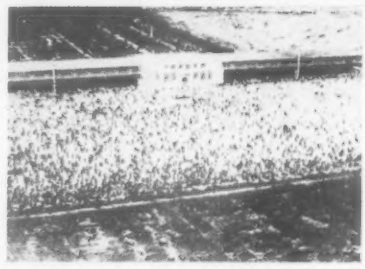
All prizes confiscated are distributed to the various government bureaus which have jurisdiction. Rum-smugglers are turned over to the Department of Justice, dope smugglers to the Narcotic Bureau and smuggled Chinamen to the Immigration Bureau.

The smuggling of Chinamen from Canada, Mexico, and Cuba, while not an extensive business, is a highly profitable one for the smugglers for their fee is $800 to $1,000.

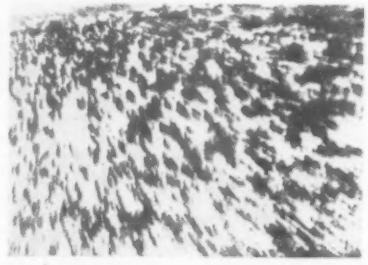
But for law-abiding mariners, the advent of the airplane in the Coast Guard's patrol work has resulted in a

(*Continued on page* 124)

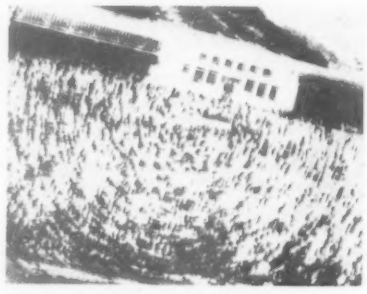
How It Feels to Go Into a Spin



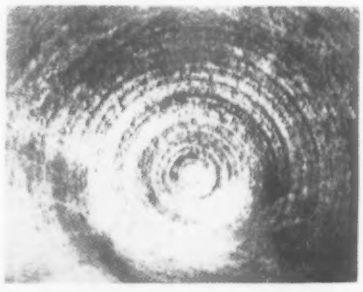
The pilot, before the spin, looks over the crowd at the field. How calm and peaceful is the landscape.



Down goes the nose and over she rolls on one wing. The spin starts, and things begin to look rather mussed up down below.



Now, she's spinning—no doubt of it. The crowd and grand stand are whirling nicely now, but they are going to whirl a whole lot faster before this spin is over.



And now she's tightened right into the spin in good shape. Things are mixing up at a good many r.p.m. Do you think that the pilot can pull out of it. Well, he must have or we wouldn't publish these pictures.

The four photos above are reproduced from Air and Air-ways, London, England.

The Prop Got in the Way

By DOROTHY DEAN
Member of Round Robin Club No. 2

IT WAS early April. The south wind, blowing over Kansas plains, was snapping the wind-sock and hurling dust balefully into one's eyes.

Ted was at the airport, running-in the recently over-hauled engine and going over the ship from prop to tail-skid, in preparation for our take-off to California. Being much interested, and very thrilled over the prospect of such a trip, I was there, too. We couldn't start any too soon to please either of us. Perhaps, that's the reason it all happened. If we hadn't been in such a hurry, he probably wouldn't have left the ship running on the chocks in all that wind.

For a while, I sat in the front cockpit trying to imagine what my first long cross-country trip would be like—whether we'd have a forced landing in the desert and wishing for a drink (as Ted said we might)—whether California was really the Heaven-on-earth I'd heard it was.

But with the engine running, the blast threw great clouds of dirt all over me, so when Ted stopped it, I climbed out and stood in front—out of some of the dust. It's funny how a little thing like dust can make such a difference in the way things happen, something like the famous horseshoe-nail.

Ted finished whatever he was doing, primed all nine cylinders and swung the prop. The motor caught instantly and turned up around 1100. Ted stepped quickly back to the side of the cockpit and did something—I don't know what. The thing that caught my attention—and held it—was the lifting tail! My first thought was—"She's going to jump the chocks and crack a wing! Something must be done!"

Perhaps I'm too impulsive, always rushing into things that I don't know enough about, but I couldn't stand there and see a $250.00 wing ruined and not try to prevent it. I didn't stop to figure it out—I acted—dashed for the nearest wing with the idea of sitting on it. Perhaps my weight might help to hold it down until the tail settled again.

I haven't a clear recollection of the following seconds. It happened so suddenly that there was no time for my brain to receive the impulse. The next thing I remember was a different noise—the sound of something being struck. And then I was sitting in the dirt several feet to the right of the plane, looking in amazement at the huge red tear just above my ankle, and wondering how my one-strap slipper got off of my foot.

I looked at Ted and he grinned. I must have looked rather comical sitting there in the dirt. Realizing that he didn't yet know what had occurred,

(*Continued on page* 122)

And Now the Ship Packs a 'Chute

How the Army Air Corps, and others, have experimented with large parachutes for rescuing the whole ship or the passenger cabin alone

THE question as to whether passengers on transport planes should wear the parachute is much discussed. There are two sides to practically every question, and the one under discussion is no exception to the rule. Some officials of air transport lines contend that to compel passengers to wear the individual parachute lowers their morale and instills doubts in their mind as to the safety of air travel.

This contention is answered by advocates of the parachute, who point to the ocean liner as a safe and popular medium of transportation which, regardless of its safety, is required by law to be equipped with a sufficient number of life boats and life preservers.

They further contend that, while the airplane has been developed to a high point of efficiency, the frailty of human nature is something that cannot be combatted successfully. That mistakes and errors in judgment are bound to happen just as surely as accidents cannot always be avoided, and that as an "ace-in-the-hole" the parachute is a mighty handy thing to have at hand when human life is imperiled.

The man who has done so much to bring the parachute to its present state of perfection—Major E. L. Hoffman, Air Corps—is still at it, working away industriously at various parachute experiments to make the world safe for flying. He is determined to make bigger and better parachutes—parachutes large enough to lower passengers in air transports by the wholesale.

Experiments have been conducted by others in the attempt to perfect a parachute which will lower an entire airplane to the ground without serious damage, but at this stage of the game, exhaustive tests thus far carried out appear to indicate that this type has not reached the practical stage.

The failure, thus far, to devise a parachute capable of lowering an entire plane to the ground should not be viewed with alarm, nor should it prove a source of disappointment to enthusiastic advocates of this safety device. As a matter of fact, it may transpire that the lowering of an entire airplane to the ground may court disaster for the pilot and passengers.

In the past, there were a number of instances where planes caught fire in the air, due to overheating of the motor, breakage of the gasoline line or other causes. The fire generally starts in proximity to the hot exhaust stacks of the engine and then proceeds to spread. To lower an entire airplane to the ground via parachute in such a contingency would prove anything but a safety measure for the occupants thereof.

Fire is a terrifying menace whether on land, on water or in the air, and any device calculated to facilitate the escape of passengers is certainly much to be desired. The proposition, therefore, of constructing transport planes with detachable cabins, which a giant parachute could lift off into space in the event of an emergency, has much to commend itself.

The Parachute Branch of the Material Division at Wright Field, Dayton, O., under the supervision of Major Hoffman, busied itself during the past summer with experiments on a huge parachute—80 feet in diameter. It was designed to lower to the ground in safety a detachable cabin of a passenger plane, together with its occupants.

This parachute, one of the largest one thus far constructed, has been tested by dropping 2,500 pounds of lead from a moving plane. Heavier loads have been used for other tests. During these experiments, a target glider, attached to the top of the center section of an airplane, served as a vest pocket edition of a transport plane.

The parachute was attached to the center section of the target glider. The center section of the fuselage of the target glider was cut out and painted to resemble the cabin of a transport plane. A slight tug was all that was required to pull this simulated cabin out and away from the target glider.

The parachute was operated by means of a timing device. After the take-off of the airplane, the time arrived for the parachute to "do its stuff." The little pilot 'chute unfurled itself to the breeze, pulled out the big

(*Continued on page* 126)

At the right is the experimental glider mounted on the top wing, ready for a test.

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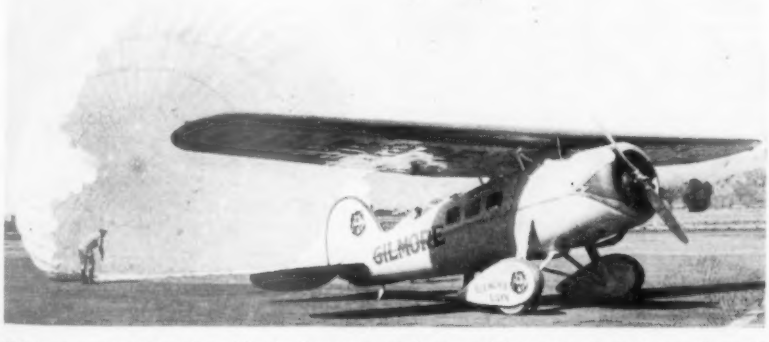
Below, is the parachute just after landing with a cabin section.



Col. Turner experimenting with the large parachute by which he intends to lower the entire cabin ship shown in the foreground.

Potent Fingers of Searching Light

(See front cover)
By PAUL H. WOODRUFF

Observation plane equipped with the new penetrating searchlight, lately put into service.

A SHARP command barked into the night. Instantly it was echoed and re-echoed, and abruptly the blurred "sluff—sluff" of many men marching on a dirt road ceased.

The halted company, relaxing as at every opportunity, whispered interrogations, gazed unavailingly into the surrounding blackness, and then stared upward to where a dim point of light, like a feeble near star, drifted slowly toward them. From the star depended a faint, rigidly vertical pencil of light.

It was this phenomenon which had caught the officer's alert eye a few moments before. Now that the earth sounds had ceased there became audible the high-frequency staccato of a motor, perhaps ten thousand feet above them.

As the invisible plane approached a point directly overhead, its tell-tale spot of light grew rapidly brighter and brighter, until suddenly it became a blinding, concentrated flood of illumination. But despite the revelation of their position, the old timers in the company breathed easier for a moment.

At the speed the plane was flying, a bomb released now would strike far to the left, and do no damage. A hasty consideration of the problem involved convinced the officer that his company offered a poor target for a night-flying bomber, in spite of its searchlight.

Even as he reached this comforting conclusion, the advancing pencil of light appeared to lose interest in the motionless columns of men. The light-flooded area of ground, a spot little more than fifty or sixty feet across, shifted sharply to the left and began to explore a deep gully that raggedly paralleled the road a quarter mile away.

The men watched it, fascinated, as it carefully followed the twists and turns of the ravine, leaving them in welcome darkness. Nothing more came from the plane. But suddenly the very road itself arose in a huge billow which flew to pieces with a blinding, intolerable flash and crash. The beam of light traveled rapidly on down the gulley; and again came the instant tidal wave of earth, the overwhelming flash and crash.

In the fleeting instant of too brilliant light, it might have been seen that the air was filled with strange, wriggling shapes that disappeared into the sea of darkness made doubly black. A few —pitifully few—of those same shapes crawled slowly away into the ditches and fields. Then the star and its pendent pencil of light went out, and the beat of the plane's motor faded into distance and silence.

Had there been anyone to look down into that gulley as the light beam traversed its tortuous length, there would have been observed, at two points, a faint and apparently insignificant sparkle, as though a bit of glass or bright metal reposed there. And, strangely, it was just as these small sparkles appeared that the devastating upheaval of earth occurred. There was more here than coincidence. The Nth company of infantry had literally been destroyed by a beam of light.

(*Continued on page* 123)

Predicts 100 Ton Transports

DRAMATIC changes in world transport and communications are foreshadowed in the building, on the banks of the River Medway at Rochester, England, of a slipway where flying boats larger than any yet to take the air may be erected and launched.

Aided by the extensive development of metal construction methods, flying boat designers have planned craft worthy to be styled "flying ships." Two airboats, now under construction in British factories will each weigh, when fully loaded, no less than 30 to 35 tons. Considerably larger vessels up to 90-100 tons, are contemplated.

Flying machines of this size cannot be erected inside the largest sheds. Their overall height from the keel to the top of the superstructure is too great. Already the company responsible for the new slipway has had difficulty in building big three-engined boats with a gross weight of eighteen tons inside the biggest shed at the Rochester works.

In the future, the hulls of new flying ships will be constructed within the hangar and the work of erection will be done on the slipway, from which the big machine will ultimately be launched. Thus, one branch of aeronautical engineering is fast coming to resemble marine construction, and flying-boat "yards" promise soon to rank with the shipyards.

From the aircraft slipways will move a succession of big craft, able to cruise thousands of miles—non-stop—and to carry a heavy load swiftly and safely along the world's sea routes. In the perfection of these big marine aircraft lies, perhaps, the greatest promise for the future of long distance airways.

More efficient and faster than the airship, they should be able to operate on regular service all over the world before many more years have elapsed.

That the vision of the "flying ship" is to be pursued to actuality is clear from present purposeful development in this country. The next step, following the successful trials of the two 35-ton boats, is already planned. Then, a 60-ton boat, designed for the commercial operation of a transatlantic service, at a cruising speed of more than two miles a minute and with a range of no less than 2,500 sea miles, is receiving official consideration.

This air leviathan, probably built largely of stainless steel, will be planned to carry passengers and a big load of luggage and mails in extreme comfort. It will have sleeping accommodations resembling the passenger decks of a water-borne ship.

Such a craft will be able to cross the Atlantic Ocean in less than 24 hours. And it by no means represents the limit of size; at least one British flying boat designer has made preliminary calculations for the construction of a flying boat weighing more than ninety tons.

What Our Readers Are Building

A department devoted to our readers' activities in airplane and glider construction.

WHEN we started this department in the January issue, we believed that we had hit upon an idea that would be popular with many of our readers, but at that time we had no conception of the intense interest really taken in home-built craft. The results of this first venture amazed us, hence this department is likely to become a permanent feature of POPULAR AVIATION.

Letters have literally been pouring into the office, and many of these comments and criticisms have been very instructive and worth while. It is quite surprising to discover how many of our correspondents claim success with home-built aircraft equipped with reconstructed automobile engines, engines from Fords, Chevrolets and Franklin cars.

Now, we are just going to remind you that this department is *your* department, to be supported by your contributions of articles and photographs. It is strictly up to you fellows to keep it going with descriptions of the lightplanes, gliders and aero engines that you have built. So—write in at the first opportunity, and we will see that your articles or letters appear—provided that they are accompanied by good, clear photographs of your machines.

You don't need to be an experienced magazine writer. Just send us the main facts in the matter and we will rewrite the stuff here in the office for you. If you think that a few sketches would explain things better, just send in pencil sketches and we will have our artist fix them up. Owing to our limited space we would like to keep the articles down to about 500 words, but if the subject is sufficiently interesting, we can allow up to 1,000 words. So, fellows—kick in with the dope.

He Has Built Seven Sport Jobs

WE WILL have to hand it to Bert Backstein, 1304 E. Logan St., Decatur, Ill., for being a real sportplane enthusiast. He sends in an interesting letter with a photograph of his latest production which will appeal to all home-builders. Bert speaks as follows:

A few lines to you, giving you a little information that we have at hand. I have noticed from time to time in POPULAR AVIATION, *that many lightplane builders are having a lot of trouble building ships with converted Ford motors, and in this connection I wish to state that I have had about 16 years' experience designing, building and experimenting with sportplanes of this class and altogether have built seven sportplanes.*

Edward Molitor and his classy little homemade monoplane.

For two years, I have been experimenting with a four cylinder Chevrolet motor, and now have it down to a point where there is no vibration. Altogether, I have had about 40 hours with this motor with no trouble at all at any speed, and I have not put many special parts in this motor.

I have built a fast little single-seat monoplane around this motor—a center wing job. This plane is now almost ready for the test hop, and I hope to

A Chevrolet engine is the power-plant used in Bert's ship.

show your readers what you can get out of a four cylinder automobile motor.

Span.....28 *ft.*
Chord.....4 *ft.*, 8 *in.*
Length.....18 *ft.*, 4 *in.*
Weight, Empty.....450 *lbs.*
High Speed.....100 *m.p.h.*
Landing Speed.....30-35 *m.p.h.*

We have our own experimental field here, and are not afraid to show it at any time. Let us hear from you.

Well, well, I think that a number of fans will write to you, for there is a lot of enthusiasm about just such jobs as this. Further, let us hear from you again, Bert, telling us just what success you had with this ship.

Flies Home-made Ship

EDWARD MOLITOR, age 20, of Pelham, N. Y., has been making successful flights with the homemade plane illustrated by the accompanying photograph.

The flights took place at Roosevelt Field, N. Y., and because the ship was not licensed, it is said that he ran into a number of difficulties with the local inspectors.

Molitor claims that he knew nothing of the theory of aerodynamics nor had he any practical aviation experience before he built the ship. In view of these facts, his success is quite remarkable and it should be an inspiration to other amateurs who are considering building or buying lightplanes.

Still Another Ford Job

WE ARE in receipt of an interesting letter from Donald K. Finke, Spring Valley, Minn., who writes in to defend the Ford engine. He has had a world of experience at this game, as you will see from his letter, and he should be an inspiration to beginners in this field.

In May, 1929, we wheeled out the first Ford motored ship built here, and I tested it. It sure flew fine. It was a

At the left is Donald Finke's trim little monoplane with a Ford engine, standing alongside a Curtiss Robin.

two-place, high-wing monoplane, weighing 640 pounds empty. Later, I carried passengers in the ship and even went so far as giving instructions in it. Since that time I have probably carried 250 passengers and have done quite a bit of instruction. The only thing that was changed was the oiling system. I used the original battery ignition and carbureter. There were no thrust bearings nor was there any need for them.

Since that time, I have owned three ships powered with the Model "A" Ford motor. I sold two of them, and to my knowledge they are still going strong. I have gone on cross-country trips of 200 miles, non-stop, with a passenger. Altogether I have about 400 hours and have traveled 25,000 miles in the air with nothing but a Ford motor.

This is the reason that I don't like J. B. Roberts' statement in the December issue of POPULAR AVIATION, *that "the Ford motor is all hooey." Of course, there are better engines on the market, but not for the money that you can get a Ford motor. In using a motor of this kind you can't expect to have a nice upholstered cabin job with all of the refinements that the higher powered ships have, nor do the lightplane fans ask it.*

As for standing up, I dare say that one Ford motor will wear out two airplanes, not because they vibrate, for they haven't any more vibration than the OX5—if as much. You can put on 200 hours and the motor isn't any more than worn in. It turns up to about 1,700 r.p.m. on the ground, and will cruise at about the same speed, so you see that they don't have to work very hard. They will turn up to about 1,900 r.p.m. in the air with a regular Ford head and will turn 120 r.p.m. faster on the ground with a Ruxtell aluminum cylinder head. With the latter, the vibration is almost nothing.

And when it comes to maneuvering a ship with a Ford motor, they will work as well as any OX5. In fact, I have looped, rolled and spun with them as much as I would with any ship powered with an OX5. Just to prove that what I've said is true, I'll ask anybody weighing under 200 pounds to take a ride, and if I can't carry them, I'll give them the ship.

That's not all. I have also flown a single-seater ship powered with a Model "T" Ford motor on a cross-country trip of 125 miles, and it neither stuttered nor quit in a rainstorm. Of course, this ship was equipped with high-tension magnetos and a waterproof top. The picture enclosed shows the ship I have now, standing beside an OX5 Curtiss Robin. I hope to hear from some of the lightplane fans.

It rather looks as though we have the beginnings of a Ford Motor Lightplane Club, with Model "T" and Model "A" divisions. This is a mighty useful bit of information, and I'll bet that our contributor will be greeted with a number of letters from other lightplane fans.

Reader Builds Both a Glider and Plane

WE seldom hear of one person building both a glider and a lightplane in one year, but this feat was accomplished by Alphonse Courtines, 10 E. Green St., Johnstown, N. Y. He built both the Mead glider and the Heath Parasol from plane published in POPULAR AVIATION.

He flew the glider successfully without instruction, but was not up to the flying of the powered ship until its flight was demonstrated to him by Guy

The Heath Parasol constructed by Adolph Courtines.

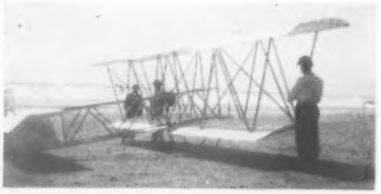
Wilmot, who took it up for 15 minutes shortly after it was built. This flight took place at the Gloversville, N. Y., Airport.

He then took it off himself for three short hops, and on the third attempt he stalled it. The plane was badly damaged but Courtines was only slightly injured. As the State of New York does not permit the flying of amateur-built planes, it was not thought advisable to make repairs.

A Novel Hang Type Glider

WE WERE very interested in a letter sent by Charles Bushnell, 1813 West Second Street, Aberdeen, Wash. This letter describes a biplane hang-type glider of very original construction, and the letter is so well written that we are printing it, almost word for word.

I have made some glider experiments



The Bushnell Glider.

this summer which may be of interest to your other readers. These experiments were under consideration for a considerable length of time before I finally started, and related to the construction of a very light glider of the "hang" type, but with full control—a very difficult proposition.

I had formerly worked out an efficient design, but its cost was so great that I changed to a new design in which simplicity and low cost were the first requisites. The result was this thin winged biplane glider with a structure almost entirely of wood. There are only two metal fittings on the horizontal stabilizer and no brace wires at all except for the skid braces. Wire control —of course.

The controls were rather unusual, consisting of two joy-sticks spaced about 15 inches apart on a common cross-member. The right-hand stick was the usual joy-stick, but the left stick worked the rudder in place of the usual rudder bar. In a hang glider, of course, it was impossible to operate a foot control, hence the novel adoption of the rudder control stick.

The glider had auxiliary skids for carrying it, and for landing, which is quite a convenience. By conserving at all points, the total cost was only thirty dollars. It was built quite strongly and weighed only 85 pounds complete. Further, it was strong enough to carry a small engine in case that powered glider operation should be decided upon later.

This is quite light when we consider that the total wing area was 220 square feet. The span of the upper wing was 26 feet while the span of the lower was 20 feet, both wings having a five foot chord. The U. S. A.-4 wing section was used in place of the thicker sections more commonly employed with monoplane gliders.

In flying, the pilot straddled a seat similar to a bicycle seat, set the controls and lifted the machine. The wind supported the weight of the machine as soon as the tow-car moved and when the pilot took hold of the controls. In practice, I ran until it was going too fast—then I would jump. At first, I would jump only about one foot high and approximately six or eight feet in length, increasing to as much as five or six feet high and twenty to forty feet in length before I would get it to fly instead of kiting.

The landing was a very strenuous affair because of the speed. Unfortunately, most of my flying was jump-hopping of only a few feet, for I was flying it from the beach. The beach never became solid this year and the cars could not make sufficient speed.

I would jump, and if the car hit a solid spot, it would speed up. I would then push the nose down, the car would slow up, and even though I fought down to the last inch, I could not stay up. However I did make some flights of several hundred feet. When I first tested it, I was without the sponge rubber cushions, and as a result I was very black and blue—both fore and aft.

I did not have any real accidents, though once I thought I was going to break the glider all to pieces. It happened that we were forced by circumstances to wait until the tide was nearly in before we started, but we started anyway. Just after starting, I was struck by a strong gust of wind; I grabbed the controls and up I went like a balloon.

One of the boys at the wing tips

(*Continued on page* 131)

Question and Answer Department

QUESTIONS relating to the general subject of aviation will be gladly answered in these columns by our staff of experts, providing that they do not involve much research work and are of interest to our readers. Among the subjects admissible are simple problems in aerodynamics, maintenance, operation, construction and aeronautic engines.

The answers to your questions have two purposes. First, to give you the information you desire, and second, to present interesting subjects to our other readers who enjoy discussions of this sort. It is for the latter reason that we wish to avoid questions dealing with purely personal matters or subjects that do not concern our other readers.

This department is open to all of you, and we heartily solicit your questions and problems within the scope mentioned above. Send them in. We will be more than glad to take care of you. There are a whole lot of pertinent subjects that have not already been covered, and if you will write in, we will do the best we can. This service is free to everyone.

Address your letters to the Question and Answer Department, POPULAR AVIATION, 608 S. Dearborn St., Chicago, Ill.

* * *

QUESTION:—Herman L. Schultz, Aberdeen, S. D. *I have read a great many books in which the term "specific gravity" appears. I have also noticed the word "density." Is "specific gravity" the same thing as "density" or have they a different meaning?*

Answer:—I WILL start this answer backwards by giving the definition for "density" first. Density is the weight of a substance per unit volume—that is, per cubic foot or cubic inch. Thus, the density of water can be expressed as 62.4 pounds per cubic foot.

On the other hand, specific gravity is the relation of the weight of a unit volume of the given substance to a unit volume of distilled water at 60 deg. F.

Thus, if water weighs 62.4 pounds per cubic foot, and iron weighs 480 pounds per cubic foot, then the specific gravity of the iron will be 480/62.4 = 7.69.

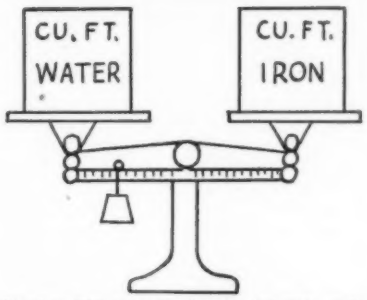
This is illustrated by the accompanying sketch, where a cubic foot of water is balanced on scales against a cubic foot of iron. The position of the weight on the scale is used to calculate the specific gravity as described above.

* * *

QUESTION:—George L. Murphy, Chicago, Ill. *A gasoline engine is called a heat engine. Is there any way of telling how much heat will be required to develop a certain number of horsepower?*

Answer:—THE fuel burned in the gasoline engine, more properly known as the internal combustion engine, contains a definite amount of heat which is converted into mechanical energy by the action of the engine.

All questions of general interest on any phase of aviation will be answered authoritatively by Popular Aviation's Technical Staff.



Showing difference in density between water and iron.

The energy contained by the fuel is quoted in terms of heat quantity, that is, in terms of British thermal units (B. T. U.). Aviation gasoline contains about 18,000 B.T.U. per pound, or approximately 90,000 B.T.U. per gallon, assuming that the gasoline weighs 5 pounds to the gallon.

Now, if all of this heat were converted into mechanical enerby or power without loss, the gallon of gasoline would produce a definite amount of power. Approximately 1 B.T.U. equals .0236 horsepower, or 1 horsepower is equal to 45.44 B.T.U. per minute. Consequently, if you divide the total number of B.T.U. supplied by the fuel per minute by 45.44, you will obtain the theoretical horsepower.

However, the engine does not convert all of the heat energy into mechanical energy. The best airplane engines utilize approximately 30 per cent to 35 per cent of the heat supplied to them.

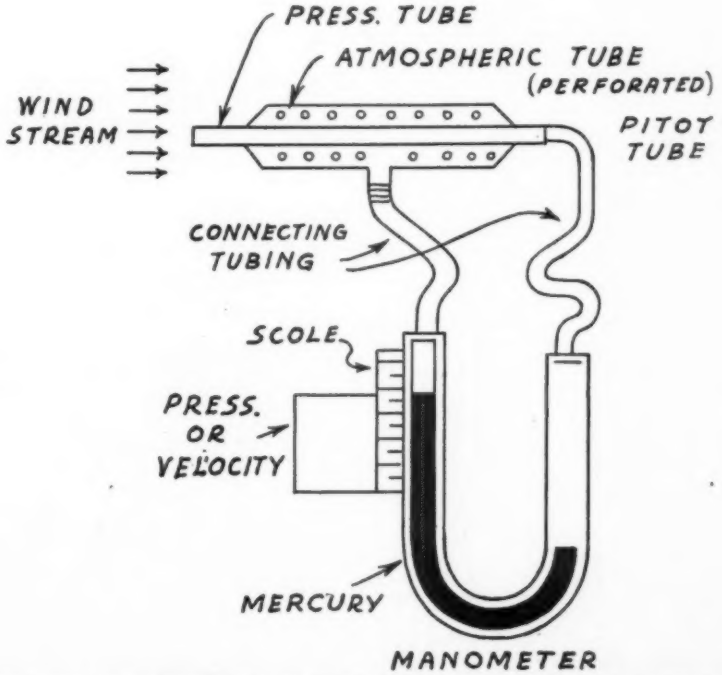
In other words, we throw away from two-thirds to three-quarters of the heat through the exhaust and the radiator. In fact, approximately as much heat is rejected to the air through the radiator alone as is used by the engine in producing useful mechanical effort.

* * *

QUESTION:—Reginald Randolph, Milwaukee, Wis. *Will you please explain the workings of an air-speed meter? Is this meter operated by the pressure of the wind or does it work on some other principle?*

Answer:—THE majority of air-speed meters are adaptions of the pitot-tube principle. The end of the tube faces into the windstream, and the impact of the air on the orifice of the tube creates a pressure that is proportional to the air speed.

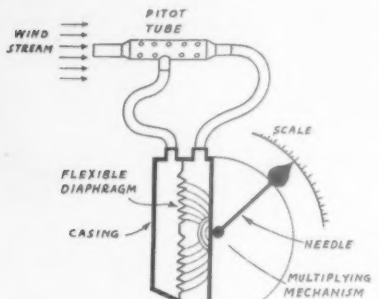
The pressure created by the motion of the air in this way is known as



The elements of an air-speed meter in which a mercury manometer measures the pressure.

the "dynamic pressure," but this pressure must be corrected by reducing it to a standard static atmospheric pressure. In other words, the dynamic pressure alone, as obtained from the single pitot-tube, is subject to variations in the atmospheric pressure. Consequently, compensation must be had when changing from sea-level pressure to some reduced pressure at a higher altitude.

In practice, the pitot-tube consists of a central cylindrical tube pointed



Air-speed meter of the aneroid type.

into the wind. Surrounding this central tube is a larger tube, closed at both ends, and covered with small perforations all over its circumference. As these perforations do not point into the wind, the space between the tubes gives the average "static" or atmospheric pressure.

Now, if we connect the static and dynamic tubes to the opposite ends of some sort of a pressure gauge, we will obtain readings that are proportional to the air-speed at any atmospheric pressure. This arrangement is shown by two accompanying sketches.

In the first sketch, the pressure difference is recorded by a mercury manometer. The pressure created in the dynamic tube depresses the mercury column, as indicated, to an extent that is proportional to the air speed. Instead of dividing the scale into pressure directly, it can also be divided and indexed in terms of speed.

This is the type of air-speed meter generally used in wind tunnels, or in other places, where the instrument can be placed on a firm foundation.

Where readings are taken of low velocity currents, liquids lighter than mercury are used in order to gain greater sensitivity. For use on the airplane, the corrugated diaphragm type of pressure recorder is used instead of mercury. This is shown in schematic form by the second sketch.

It will be seen that the dynamic and static tubes are connected on opposite sides of a thin, flexible, corrugated diaphragm in such a way that variations in pressure cause this flexible diaphragm to move back and forth.

The movements of the diaphragm are transmitted to the index needle by some sort of multiplying mechanism so that a very little movement of the diaphragm will cause a considerable movement at the index needle. It should be remembered that this is a schematic diagram only, for illustrating the principles of operation, and is not a commercial instrument.

* * *

QUESTION:—Harry Stevens, Chicago, Ill. *How is the safety factor of an airplane determined?*

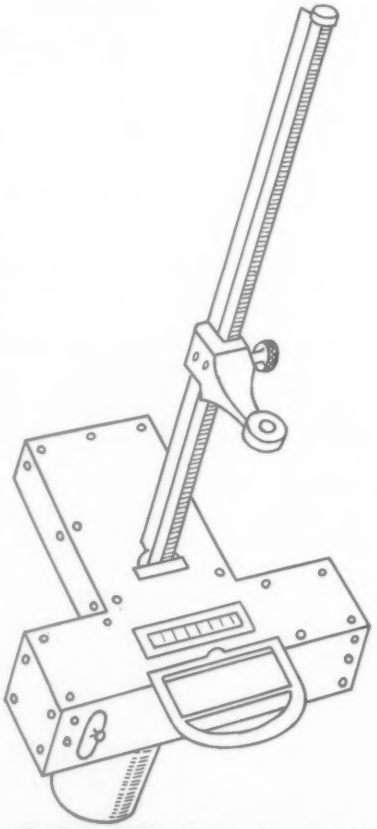
Answer:—THE safety factor indicates the relative actual strength of a structural member in relation to the load acting on it.

In other words, if the load coming on a member is 1,000 pounds, and the actual strength of a member is 5,000 pounds, then the safety factor is said to be 5.0 because the part is five times as strong as is actually necessary to carry the load.

In the design of all structures, it is necessary to have an excess strength to overcome unknown variations in the material and errors in manufacture.

Again, the strength is affected by the manner in which the load is applied or by the nature of the load, so that we must compensate for these variations by making the member several times stronger than called for by the actual loading.

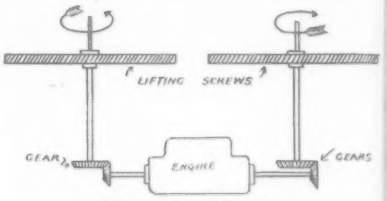
Thus, certain parts of an airplane, carrying a fairly steady load, will only be required to have a safety factor of 4.0 or 5.0, while at other points, where the load varies rapidly or reverses rapidly, the safety factor will be much higher. In the same way, materials subjected to shocks such as the landing gear will have a still greater safety factor.



The Gatty Drift and ground-speed meter used on the flight around the world with the "Winnie Mae."

* * *

QUESTION:—Charles Wallace, Memphis, Tenn. *Aluminum pistons have been used in automobile engines for many years and give very satisfactory service in spite of the high temperatures and speeds. In view of this fact, do you believe that it would be possible to use aluminum for building an airplane engine cylinder? If an aluminum piston can withstand the high rubbing speed in a cast iron cylinder, it seems to me that an aluminum cylinder would also be possible.*



Elementary Helicopter.

Answer:—ALUMINUM cylinders have been used from time to time in several American engines, one of the most prominent makes being the Roberts two-cycle engine. In this case, a cast iron piston was used inside of an aluminum cylinder bore so that we still had iron rubbing on aluminum, just as we now have aluminum rubbing on iron in the modern automobile engine.

So far as I know, there was never any trouble when this arrangement was used, but of course there would likely be trouble if an aluminum piston were used in an aluminum cylinder.

Two "like" metals usually cut each other to pieces when they are rubbed over one another at high speed. The exception to this is the use of a cast iron piston and a cast iron cylinder, but as cast iron is rather an unusual metal, no harm comes from this arrangement. Steel on steel or brass on brass or aluminum on aluminum will start cutting and scoring no matter how well these surfaces may be lubricated.

* * *

QUESTION:—Gordon MacKenzie, San Francisco, Calif. *As I understand it, the air-speed meter only records the speed of the air, but not the speed of the airplane over the ground. Is there an instrument that measures the actual speed of the ship in relation to the ground?*

Answer:—IF the airplane were flying in absolutely still air then the air speed would be the same as the ground speed. However, the wind changes this relation and may

(*Continued on page* 132)

America's 100-Passenger Ship in 1915

THE marvels of the German-built DO-X have been broadcast so many times and in such detail that they need no repetition. It truly is a wonderful ship, but do Americans know that this achievement in construction was little more than finishing off other large flying boat projects which were begun in the United States as early as 1915 and 1916?

There was little publicity given to the subject when the United States government began building a multi-engine flying boat of the DO-X type during the winter of 1915 in the Curtiss plant at Buffalo, N. Y. Secrecy was necessary because all Europe was at war, and this country was slowly but surely being drawn into the maelstrom.

Only recently were the full details of that ship revealed. The immense aircraft, designed by the late Glenn H. Curtiss, was designated the Model "T." Until the DO-X was built, the "T" was the largest heavier-than-air craft ever built.

It was built to carry upwards of 100 passengers, and so confident was Mr. Curtiss of its airworthiness, that his first plan was to fly it overseas.

The hull, or passenger-carrying compartment, was built of wood. Its size was such that it was necessary to ship the hull from the factory in Buffalo to New York by way of the Erie canal and the Hudson river, as railway cars could not handle the huge boat.

The wing construction was of the tri-plane type, while the power plant consisted of four motors set in the center wing—tractor fashion. The total weight of the craft, without gasoline, oil and crew, was 22,000 pounds. The wing span was 137 feet.

A novel arrangement of the tail group consisted of triple rudders and only one vertical fin coming up from the boat hull at the center. One long horizontal stabilizer, and two elevators running the full width of the stabilizer, completed the tail group. The top horizontal control surface, or elevator, was hinged to the top of the rudder posts and not to a fixed surface as is generally the custom.

During construction of this craft, decisions and changes in plans came often. For instance, at the last moment it was decided to install Rolls-Royce motors in England, and this decision probably robbed the "T" of making the first ocean crossing by air. So the hull and wings were finally shipped by steamship to England, and there its further history was engulfed in the barrier of war censorship. As far as is known, no report of its testing or use in war time was ever made.

Planes Survey Country

SUFFOLK County, New York, has completed aerial survey of 1,000 square miles, as an acurate basis for assessment work.

Ships That Fly Tail-First

An American Canard built by the makers of the "Gee-Bee" racing plane.

CANARDS, or tail-first machines, seem to be growing into favor rapidly to judge from three of these ships that have recently come under our observation. First, we had the freakish looking German ship provided with double hulls and a ram's horn member carrying the forward control surfaces.

Now, we have one American and one English entry into the canard division. As you probably know, "canard" is the French word signifying "duck," but just why these planes should be called "ducks" is more or less a mystery to us for we have yet to see a duck flying tail first.

There are many arguments for and against this type of construction, but the fact remains that the original canards built early in the history of aviation were discarded for the "tail-last" machine.

It will be remembered that the first Wright gliders and power-driven planes were of the canard type. Santos Dumont built a canard type, the first ship to fly in Europe. Then the Farmans tried it and the whole flock of amateurs that followed them. Finally they gave the idea up altogether and nothing was heard of the canard until the recent revival.

The American canard entry into the Hall of Fame, shown above, is the Granville "Ascender" of which little is definitely known at the present time. As the photograph shows, this is a high-wing monoplane with the elevator and stabilizer located in front of the wing and supported by an extended arm running forward from the cabin.

A tractor type propeller and engine, located at the center of the wing and above the pilot's compartment, drives the ship tail first. It will be noted that a very large vertical fin surface is provided at the rear, and that the rudder is hinged to the rear edge of this fin. It is said that this type of ship is cheap and simple to build, and this is probably the reason why there is so much activity in this direction.

Below, we have an example of an English canard which is larger and more elaborate than the small American machine. This is a twin-engine affair, also provided with tractor screws, and has a most peculiar fin arrangement.

The forward stabilizer and elevator form a triangular control group, with the elevators hinged at an angle to the wind-stream.

The English Canard shown in flight from left to right.

The Prohibitive Cost of Super-Speed

by JOHN B. RATHBUN

+ + +

Further Evidence That 500 M. P. H. Can't be Done

+ + +

FROM time to time, in these columns, the writer has made various predictions and prophecies to the effect that there is a decided upper limit to the speed obtainable with present type airplanes and their powerplants. I had estimated the upper limit at 500 m.p.h., amidst the "boos" of the assembled multitude—yet I still believe that 500 m.p.h. is very close to the ultimate.

In previous writings upon this subject, the 500 m.p.h. limit was arrived at after considerations based upon wind tunnel tests and free projectile flight. Starting in with Newton's Laws of Motion, and then continuing up to the latest findings of the ultra-modernists, it's a cinch that the air resistance of a moving body increases a whole lot more rapidly than the speed, and with this increased resistance comes a correspondingly greater demand for motive power.

I understood this basic fact thirty years ago, when Gustave Eiffel and the Marienfeldt-Zossen line carried out their work on air resistance, and even in all this time, it is not possible that the elementary laws of physics have changed basically. In 1900-1902 it was common knowledge that the air resistance increased as the "square of the speed" from the lowest possible speed to speeds averaging 100 m.p.h. Later, it was discovered that the resistance increased even at a greater rate at higher speeds, until a very sudden jump upward took place after the 300 m.p.h. mark was passed.

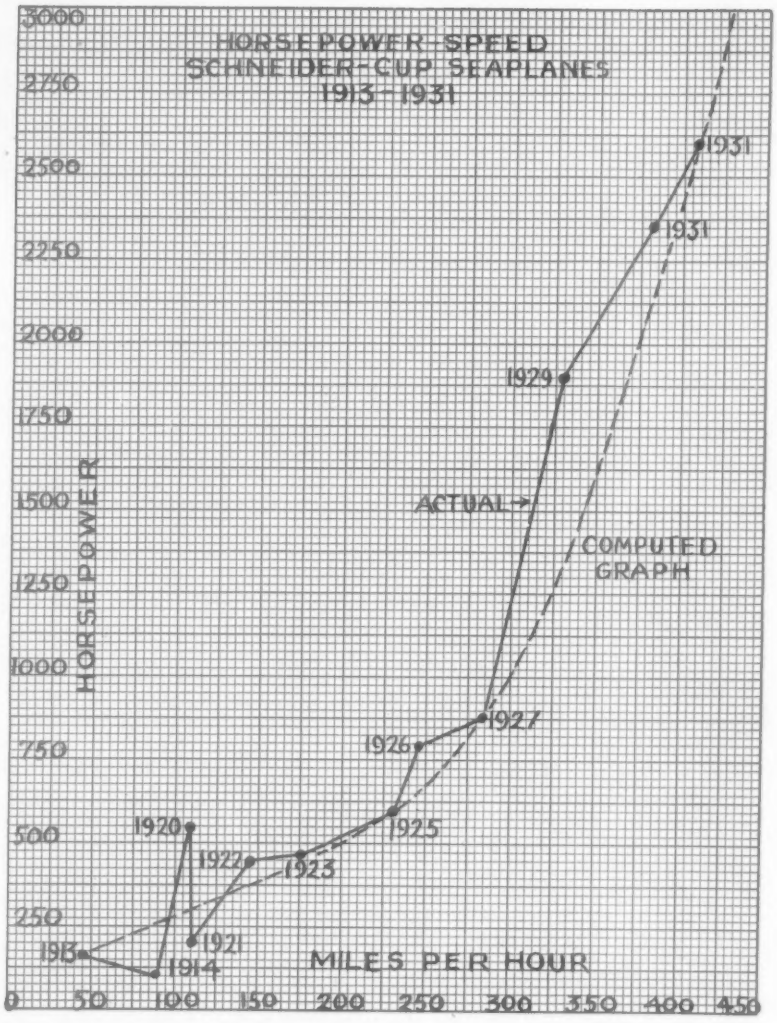
With the coming of air tunnels, and more refined measuring apparatus, it was found that the resistance increased according to the fifth power when the velocity of sound was reached at approximately 1,080 feet per second. In common units, this corresponds to 736 m.p.h., a speed at which most of the eddy losses are superseded by vibrational loss. The airflow changes its nature so that streamlining is not very effective from 350 m.p.h. up to the velocity of sound, and this alone accounts for a certain amount of the sudden change in the laws of resistance.

When we are whooping it up, say at 350 m.p.h., it is evident that the air does not flow around the contour of a streamline body as it once did at the lower speeds. The air is more highly compressed at the nose of the ship and has less time in which to close in along the trailing edge, thus causing cavitation at the rear.

The total result is a gradually increasing region of "discontinuity" which is the polite phrase for a "partial vacuum" at the rear of the body. The faster we go above this point, the more she tears the air open at the rear, and the greater will be the difference between the super-compression at the nose and the diminished pressure at the rear. This in turn calls for relatively more h.p. from the already overworked engine.

This was all more or less based upon

(*Continued on page* 128)



The rapidly ascending graph, after passing the 300 m.p.h. point, indicates that about 7,500 h.p. would be required for a speed of 500 m.p.h.

SUPERMARINE SEAPLANES WINNING THE SCHNEIDER CUP

YEAR	ENGINE		SPEED M.P.H.	H.P./SPEED RATIO	REMARKS
	MAKE	H.P.			
1922	Napier.....	450	145.62	3.09	In contest
1927	Napier.....	875	281.65	3.11	In contest
1929	Rolls-Royce....	1900	328.63	5.78	In contest
1931	Rolls-Royce....	2350	379.39	6.20	Alternate
1931	Rolls-Royce....	2600	408.80	6.36	Post Race Trial

XUM

The Underlying Principles of Soaring

By Martin Schempp

Taking advantage of rising aircurrents, the skillful glider pilot can maintain flight for hours. Mr. Schempp, an acknowledged expert, gives full particulars on this art.

A soaring glider after launching on a hillside. The shock-cord is just falling away from the nose hook.

SOARING flight is nothing else but gliding in an upward flowing aircurrent. It does not call for any special tricks or secrets. Every second class glider pilot, who knows how to fly his training glider properly will also be able to soar when he happens to find a strong enough upwind for the type of glider he is flying.

The art of soaring, however, is to stay in this current. Hence many proud glider pilots, after they have had the wonderful feeling of being carried upward in their glider by the air currents for the first time, are very surprised to find themselves, after a short while, in a fast dive toward the earth.

What had happened? Why couldn't they get their first class glider pilot's license requiring a flight of only five minutes? Was the upwind too weak or did they even get into one of these malicious downwashes?

No; these beginners just didn't know the limits of the upwind zone, and didn't have the theoretical knowledge of the aircurrents nor their relation to the ground formation.

Where do we find these upcurrents and how can we use as much as possible of their energy for our soaring flights?

The sloping upwind zone is easily determined and is therefore the playground of all the students in soaring flight. The wind, we will say, is blowing against the steep slope of a mountain, and naturally the air either has to go around it (with a cone shaped mountain) or has to climb over it, in the case of a mountain range.

The strength of this upcurrent depends on different factors, on the steepness of the slope, on the wind velocity, on the horizontal extension of the mountain and its shape and on the formation of the terrain below the slope. Especially, is this last factor very important in judging a mountainside for soaring flight. If the wind must first stumble over small hills, or drop into a deep valley before it reaches our slope, we will never get a smooth upwind flow suited for soaring flight. The air will then come up the slope, and if it were visible to us would resemble the breakers coming up a steep seashore.

There is one case when a promontory helps to furnish a stronger upwind instead of disturbing it. Like the fast flowing current in a deep and narrow river-bed, the air current may be caught and forced through a deep valley which lies in the wind direction. If there is a sharp bend in this valley, the wind will strike the mountainside and climb up the slope with more speed, thereby expending more lift on the wings of our sailplanes.

Such wind catching, and wind-speed accelerating effect, is also found at an incision in a slope. However, this is only true at just one certain wind direction and already a slight change may cause disturbance and even down currents. The upwind at steep seashores or high sanddunes also comes under the type of slope upcurrents.

At nearly vertical rising ridges, dangerous air eddies are formed close to the ground. These eddies now will act like an aircushion, over which the following currents have to glide, thereby flowing upward at a lower angle—undisturbed. This is the reason why the upwind zone at steep ridges lies quite a way out from the edge of the ridge.

One has to be very careful when flying over such steep terrain, not to get too close to the slope. There is also a dangerous squall formed right at the steep edge which makes the shockcord start of a sailplane difficult, particularly in high winds.

IN STARTING at such a place, double the usual number of boys should pull the cord to give the glider plenty of starting speed to overcome the eddies. Naturally, the wings of the plane will enter the air disturbance first, and will try to nose up the ship. The pilot will have to be on his guard and keep the stick forward.

For the mentioned reasons, the so-called "standing start" is often preferred. This means that the plane is anchored by its tail, and each shockcord end is stretched out and tightened to another in the ground. Now the pilot takes his seat and releases the tail anchor of the plane.

Only high performance sailplanes of sturdy construction should be used for such a catapult start, for the plane has to stand the enormous tension strain of the stretched out shockcords for several minutes. Also, there is a much more rapid acceleration in such a start, which may cause trouble to inexperienced pilots.

Another starting method, which has just been tested and proved to be much safer, is recommended for the terrain conditions mentioned above. It is the "plug-and-pulley start," in which flexible 3/32 inch steel cable of about 800

(*Continued on page* 119)

VELOCITIES OF RISING CURRENTS

	Result Vertical Velocity Per Second
Slight slope upwind and slight thermal upcurrent	From 2 to 3 ft. per sec.
Strong slope upwind with fair thermal upwind	From 3 to 10 ft. per sec.
Very strong slope upwind	12 ft. per sec.
Strong thermal upcurrent underneath and inside of cumulus clouds	From 12 to 20 ft. per sec.
Front upwind in rainstorm or thunderstorm	Up to 50 ft. per sec.

The Round Robin Club

A correspondence plan for POPULAR AVIATION readers.

WELL, we must confess, we're to blame this time, for we tied up the correspondence of Clubs No. 1 and No. 2 right here in the office. And, to make it worse, we did this right after lecturing you fellows about delaying your correspondence.

Just as we promised you last issue, and we mean it, we are going to run Miss Dorothy Dean's article in this issue —so look for it. As a matter of fact, old Club No. 2 should be quite proud of their aggressive member, although, according to a letter from her, she is somewhat damaged by the accident she describes.

At first we thought this article was pure fiction, but Miss Dean assures us that it is the straight goods, and that she is willing to swear to an affidavit before a notary to that effect.

Now, that everybody is getting active in the club, it is taking a lot of skid-greasing to keep things moving. Every once in a while, we receive a complaint about some club being tied up by a delinquent member. Well, we have plenty of grease and the will to use it, so, if any more tie-ups occur, we will do our best to untangle them.

And then there is another funny thing. Our remarks in the last issue about the air mail are certainly bearing fruit, because practically every letter received from a Round Robin member during the past month has come by air mail. It would be interesting to know whether these letters are flown in by Hamilton Lee, Capt. Vance, or some of the other old mail-hoppers who have been splitting the air for the last ten years. Too bad that the pilot's number isn't marked on the stamp.

When we first started this club we got ourselves into a lot of hot water by complicating the enrollment system. This has now been simplified down to the point where all you have to do in order to become a Round Robin member is to send us your name, address and age. Address the Round Robin Club, POPULAR AVIATION, 608 So. Dearborn St., Chicago, Ill. After we receive your letter we will assign you to some club and you will be ready to go.

Club No. 11

(2) Richard B. Zimmerman, 3009 Walnut St., Harrisburg, Pa. (3) Alex Dyndink, 34 Queen St., Plainville, Conn. (4) Nathan Frank, 4165 Dalrymple Ave., Baltimore, Md. (5) Paul E. Morsey, 55 Clarendon St., Boston, Mass. (6) Terrence J. McKaig, 27 Wyman St., Worcester, Mass. (7) W. R. Redfield, Box 291 Baton Rouge, La. (8) Ted Buller, Ridgetown, Ontario, Canada. (9)Henry Crampton, 180 Garside St., Newark, N. J. (10) Robert D. Hawkins, Ashley, Ind. (1) Paul Orrick, 127 East Center St., Canton, Miss.

Club No. 12

(2) Orville W. Shipley, 98 Bigelow St., Pittsburgh, Pa. (3) Charles C. Meigs, 5525 Ethelbert Ave., Baltimore, Md. (4) Harvey E. Reed, Jr., R. R. 1, Box 3, South Bend, Ind. (5) Robert Shroder, 906 Bellaire Ave., Dayton, Ohio. (6) Luverne Meyer, Oelwein, Iowa. (7) A. F. Bonjoino, 314 West Indiana Ave., South Bend, Ind. (8) J. Paul Waldrop, Lewisburg, Tenn. (9) Walt Grubbs, 1810 Ingleside Terrace, N. W., Washington, D. C. (10) Ivan DePree, 717 33rd St., South Bend, Ind. (11) Clifford Allsopp, Clymer, Pa.

Club No. 13

(2) Wm. Morrell, 52 Corson Ave., Tompkinsville, Staten Island, N. Y. (3) Robert A. Nova, R. 2, Box 23R, Fontana, Calif. (4) June King, 5808 Seventeenth, N. E., Seattle, Wash. (5) Nathan Montgomery, care B. F. Fox, 508 4th St., Cookeville, Tenn. (6) Lester Rodman, 87 W. 169th St., Bronx, N. Y. (7) Wm. P. Bradley, Jr., 822 Thron St., Sewickley, Pa. (8) Forrest McConnell, 2454 N. New Jersey St., Indianapolis, Ind. (9) Robert Reynolds, 42 Carmen Ave., Lynbrook, Long Island, N. Y. (10) William Neubauer, Box 32, North Olmsted, Ohio. (11) Ivan Begly, R. 6, Wooster, Ohio.

French Gliding Society

THE Avia Society is the national gliding organization in France. It is located at La Banne d'Ordanche, in the Auvergne Mountains—almost in the center of France.

Captain Thoret, gliding champion of France, with an Avia-20-A glider, has made two very interesting flights. The first was of 4 hours 40 minutes duration, and the second was 4 hours 30 minutes.

It is particularly interesting to note that the Avia-20-A is a standard school glider without any improvements. This type is used by a great number of gliding clubs in France.

Another flight of 3 hours 30 minutes was made by M. Auger upon the Rapace glider, also of standard construction.

Predicts Future Military Plane

THIS is what the military airplane of the future will be, according to Lawrence D. Bell, vice-president and general manager of the Consolidated Aircraft Corporation.

A two-seater monoplane, with a maximum speed of 350 miles an hour, an engine of 1,000 horsepower, retractable landing gear, enclosed cockpits, and scientific streamlining.

Mr. Bell would also like to see the standards for private pilot's license raised.

"Instead of ten hours of dual control and ten hours of solo," he said, "I think that 100 hours of solo—at least —should be made necessary. When we look at the efficiency of Army pilots and the training courses they undergo, the need for higher qualifications for private fliers becomes apparent."

The Junkers Junior All-Metal Ship is Neat

Junkers, Jr., low-wing monoplane.

HERE we have a good view of the Junkers Junior, so popular in German amateur flying circles. This, while certainly a junior in the family of gigantic Junkers transport ships, is really no fledgeling nor lightplane.

It is an all-metal low-wing monoplane, characteristic of the Junkers company and is provided with fore-and-aft cockpits for the passenger and pilot. It is provided with interchangeable landing gear and pontoons so that both water and field landing is possible.

This ship is the equivalent of an American trainer and is said to be very sturdy and stable. It is also evident that the German builders still prefer to employ corrugated metal covering instead of the smooth plates and sheet now used with American all-metal ships.

All Right, Girls—Go to It

MORE than 1,300 young Italian women are taking advantage of free instruction by government pilots in the art of flying airplanes. All classes of people are represented in the group, including a hundred or more peasant girls, three princesses and four duchesses.

Photo of the Red Knight

A RARE photograph of Baron Richtofen, the "Red Knight" of Germany, has been loaned to us for production by Walter Heinsen, author of many well known war stories. Here we see the Red Knight in conference with other German flight officers, presumably before one of his daring flights. This, we feel certain, will be of great interest to the collectors of wartime photographs.

Richtofen (at the left) with German officers.

XUM

How to Build Your Lightplane Correctly

By F. NAGLE

Mr. Nagle gives expert advice to the home builder on the proper selection of materials and tools.

Part 1.

EVERY home-builder will soon discover that the construction of a lightplane is something more than simply taking off figures from a blueprint.

Sooner or later he will run into difficulties with the selection of material, the method of handling the material, or in fastening the various parts together. These are all shop kinks, it is true, but they are kinks that are absolutely necessary to know if your ship is to be a success.

Probably not more than one out of a hundred home-builders knows how to fit the fabric on the wing or to properly dope the fabric after it is in place.

Then, we have the problem of welding before us, which is a trade all by itself. We have to work hard dural and finally end up the job by painting the ship or else varnishing it as a protection against the entrance of moisture.

All of this takes shop experience and it is the purpose of the present article to explain the most important of these shop operations. It is not my purpose to take up the construction of any particular type or make of ship, but rather to indicate the correct method of building the parts for a lightplane in general. We believe that anyone contemplating the construction of a lightplane should thoroughly investigate shop-processes and practice before attempting the actual construction of his ship.

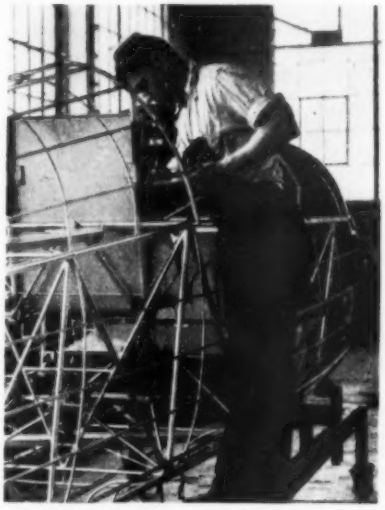
First comes the matter of wood construction, which is still a factor in lightplane construction. It is a compromise between cabinet making and carpentry, with a number of special angles introduced into the work.

Experience has proved spruce the best material for use in wing structures or parts where a light and strong material is required.

Pine, or woods of similar nature, should never be used for highly stressed parts such as spars, ribs, longerons or struts. In some sections of the country it is difficult to obtain good spruce, of high quality and in long lengths—free from knots or splits.

However, in no case should you substitute any other variety from that which the manufacturer specifies. There are concerns in this country that ship by express or freight, the finest of aircraft spruce, in any finished length or size, as cheap as in your locality for woods of similar nature.

The best of spruce should be selected, free from all knots, splits, checks or bruises. It should be seasoned properly and free from case-hardening.



All steel tubing must be carefully painted as a protection against moisture.

Improper seasoning is the cause, a condition where the outside of a plank is somewhat brittle and harder than the inside.

It is a good idea to supply yourself with the following tools for use in building the woodwork of your ship: Hammers, regular claw, brad or tack, and a machinist's ballpein. A supply of the various types of chisels and a few assorted screwdrivers, together with a good plane of medium size, are tools that you will find indispensable.

Obtain a supply of wood clamps of about the size you think you will need. They are needed for the glue work and elsewhere where pressure is needed to hold an object in place. A circular saw is a great help, but a good hand saw will take its place if the price of a circular saw is too great.

A "coping" or "jig-saw" is also necessary and a small keyhole saw will be useful. Other tools, such as wood rasps, combination squares, etc., will be needed if good work is to be done. All edged tools should be kept as sharp as possible, for otherwise it is hard to do good work.

After you have obtained your wood, either rough or sawed to the finished size for use on the plane, you should consult the plans for the sizes that you will need to cut. Be careful that you check all measurements, both to be sure that the ship will be built correctly and so you will not waste wood.

In planing or sanding wood, be sure to plane or sand with the grain. Going against the grain results in a rough job, because the fibres of the wood turn up. When grooving or routing spars or any other wood members, be sure that your tools are extremely sharp and that you leave no sharp corners. Round off all such sharp edges and corners with heavy sandpaper or a light cut of the tool.

When glueing up stock, always use casein glue mixed according to directions on the package. Allow the glue to soak in well before applying the clamps or nailing. When glueing woods of different varieties, such as ash and spruce, spread the glue on the harder of the two first, for it takes longer for the glue to penetrate the hard wood. This method is necessary. After the glue has been on the hard wood for a while, the glue can be put on the softer wood and then the clamps are applied. Painting and finishing the wood is taken up in a later paragraph.

The designer of the lightship usually specifies in the plans the variety, gage and characteristics of the metal to be used in building the fittings and other sheet metal parts. When purchasing the metal for your ship, get nothing but that which is called for in the plans. You may be unable to get the proper kind of metal in your own town, and if this is the case, the best thing to do is to order the metal from some aeronautical supply house. They stock all standard sizes and varieties of material in the line of aeronautical metals. Tubing can be purchased at the same place.

For working the metal, you will need the following tools: Machinist's hammer, one or two cold chisels, a good hack-saw with plenty of blades, a set of good files, a set of iron or metal drills with a good drill stock, pliers, wire cutters, tin-snips, center punch, and a pair of dividers.

When fittings have to be cut out of heavy sheet, the easiest way is to make a pattern of the fitting. Trace it on the metal and then cut it out with a cold chisel. Lighter sheet can be cut with a heavy pair of tin-snips. Cold-rolled steel should never be heated before bending, for heating is sure to weaken the structure of the metal. In the end, it is best to bend all metals cold.

Make all fittings a little oversize and then finish to size with a file. Before drilling the holes for the fitting bolts, a center-punch should be used to mark the center of the hole so the drill cannot run off.

Hard dural, in sizes thicker than 3/64 inch, is difficult to bend at right angles without cracking. If the bend

(*Continued on page* 123)

JUNIOR ACTIVITIES
Edited by Paul W. Clough

Don Miles earns his living and schooling by "bailing."

A 19-YEAR-OLD St. Paul, Minn., boy is earning his way through high school by parachute jumping.

He is Don Miles, a senior at Humboldt high school, whose father gave him financial support until he lost his job. Faced with the prospect of getting work outside of school hours, or quitting school, Don decided he must present some unusual ability.

Finally, he made up his mind to capitalize on his knowledge of parachutes. He made his first jump, from an altitude of 7,000 feet, before a huge Sunday crowd at Wold Chamberlain field, Minneapolis, and since has made enough engagements to support him. He gets $25 a jump.

Although the youth had 14 hours of solo flying to his credit, he had never jumped until his first public exhibition. He is a member of the 7th observation squadron of the United States marine reserve.

BRIEFS

WE recently heard from Herman "Nix" Kofiin, 16, of Chicago, Illinois.

Nix entered a ground school in Chicago at the age of fourteen; after the ground school he took flying instructions, just a few months before his sixteenth birthday, and soloed after six and one-half hours of dual. He says that he later cracked-up and was laid up for two months.

He now has his private pilot's license and about sixty hours to his credit. He is constructing a lightplane of his own design to fly with a Henderson converted motor. When he gets it finished he is going to send us a picture of it and we will print it so you all can see it.

* * *

Arthur Romaine, 17, of Brooklyn, N. Y., is now flying out of the Curtiss Airport at Valley Stream, L. I., instead of the Jamaica Sea Airport. Arthur has been flying an OX Eaglerock mostly. He will be 18 in April and hopes to have enough time by that time to get his transport pilot's license.

* * *

Al Robins, 19, of Roosevelt Field, Mineola, L. I., recently bought a cracked-up J5 Stearman that he is rebuilding. He should have it out flying in a few weeks now.

Flying Bombs Predicted for Future Wars

FLYING bombs and aerial torpedoes, capable of carrying a ton of high explosive, will play a major role in future military tactics. This was recently predicted by Elmer O. Sperry, who assisted his famous father in developing the Sperry robot pilot. "The mechanical pilot," declared Sperry, "will be the most important part of a flying bomb.

"The heaviest artillery can't destroy a target 500 miles away, but a flying bomb could easily blow it off the map. A plane which has served its usefulness would be equipped with a robot pilot and high explosive bombs. Then, preferably at night, it would take-off, but would be closely followed by the controlling plane flown by a human pilot.

"When the flying bomb reaches its objective, the controlling pilot will release it by radio, and down will plunge a load of high explosive. Then the human pilot will fly back to the base —safe and sound."

The air bombs and torpedoes cost far less than the heavy guns and are much more effective. To maneuver the famous Big Bertha into firing position required a great deal of time and labor, and to fire only a few shots cost a tremendous amount of money. But this would all be eliminated with an aerial torpedo. The only cost would be an obsolete plane and a robot pilot.

About nine years ago the Army made a series of tests with the flying bombs and repeatedly hit targets 60 to 90 miles away.

He Built it Out of Junk, But Still It Flew

AN AMAZING airplane flight was successfully made at Prague, Czecho-Slovakia, recently by Franz Kratochvil. This airplane was constructed by himself out of packing cases and laths with strips of canvas fastened to it with tin tacks.

The wings were attached with iron bands and nails. Pieces of pine served as wing supports. To control the steering, Kratochvil used two pieces of wire, held like the reins of a horse drawn vehicle. The propeller was cut from two pieces of common packing case wood.

At the first attempt to fly, the machine proved to be unbalanced. This the inventor remedied by simply nailing an extra strip of wood to one of the wings. He fitted in a 20-horsepower motor and started for Olmutz, 120 kilometers away.

Although the weather was so bad that military airplanes did not go up, Kratochvil attained a speed of 120 kilometers an hour (72 m.p.h.) at a height of 300 feet. When he landed at Olmutz airdrome, he saw that his machine had become warped out of shape, and as he grasped the "joy-stick" to ascend, it came away in his hand. Being impossible to fly back, he quietly pulled his home-made machine to pieces, packed it into a motor car and drove home.

An Automatic Control

EVER since the airplane became a recognized means of transport, many inventive efforts have been made to make it "fool-proof." The latest development in this direction is a new stabilizer invented by Mr. B. Roberts, of New Zealand. It is altogether a new departure in aviation, and it is claimed, will prevent a plane from nose diving or spinning.

The device is simple in operation, consisting of a lengthened "joy stick," the bottom half of which carries a light metal sleeve. To this all the controls are fixed. Inside this cylinder is a smaller one containing heavy metal, this weight being moved up and down the larger cylinder by means of a pump.

When the plane is taking off, the weight is shifted to the top of the cylinder, but once the desired height is reached, the plunger is released and the weight goes back to the bottom of the sleeve.

It is claimed that this weight will keep the plane on an even keel. The pilot could leave the cockpit and the plane would fly itself.

The invention has been thoroughly tested, and has evoked favorable comment from New Zealand airmen, some of whom have stated that the new invention will make flying safer than the slotted-wing device has done.

XUM

Practical Lessons in Flying

by JOHN B. RATHBUN

Ed talks about cooling systems, gasoline, and engines in general

"I SEE that they are all buzzed up in Europe over this stratospheric stuff," remarked Bob, the student to his friend and instructor, Ed Keith. "I wonder just what they are after—if anything."

"Search me," replied Keith. "I'm perfectly satisfied to fly where there is some air to hold me up. I'll bet one thing, though, that the controls get kinda sloppy when they are dodging around between the molecules, and it's a place where the water don't sit so pretty in the radiator as it does down in God's country—if they use water."

"What do you mean about the water in the radiator?" asked Bob. "Water's water any place you put it, so what about it?"

"Well, you see it's this way," explained Ed. "Water is water all right, but when you get up ten miles or so, it behaves differently—in fact you don't have to go up much more than 10,000 feet to find that out. It would be likely to boil over if it didn't choose to freeze solid in the first place."

"Does the engine get hotter at high altitudes?" asked Bob, "or does the water get nervous like and want to jump off?"

"No. You see that water, like other liquids, boils at a definite temperature with a given pressure on its surface. It boils at 212 deg. F. at sea-level pressure, which is 14.7 pounds per square inch.

"Now, if we go up high, where the pressure is very much reduced, then the water will boil at a much lower temperature and would therefore be likely to shoot out of the radiator. At 10 miles above the earth, it is likely that the boiling temperature would be getting down in the one hundreds instead of boiling at the old reliable point of 212 deg. F."

"Well, what can be done about it?" asked Bob. "I there any remedy for jumping water, or do they have to go back to air-cooling?"

"One thing that can be done is to choose some liquid with a higher boiling point than water such as ethyleneglycol, for example. This liquid is known more commonly by its tradename "Prestone," but it's not the only liquid that is suitable for the purpose. Then again, the water could be used under pressure by closing in the water circulating system. There are a lot of ways of solving the problem with a liquid cooled engine."

"If we used an air-cooled engine, matters would be simpler for the reason that it would only be necessary to control the flow of air around the cylinders. That's one advantage of air-cooling. You don't have to contend with boiling over or freezing up—at least.

Bob took a day off and did a little research work on engines and fuels.

"Now, there is a peculiar thing about the cooling effects of air at high altitudes with any engine, either with air-cooling or liquid cooling. The cooling effect of a cubic foot of air depends upon its density, hence the cooling effect of heavy dense air will be much greater than the same volume of thin air 'way up in the stratosphere. To get the same cooling effect with a radiator or cylinder ribs, at a point ten miles above the earth's surface, means that a greater volume of air must pass over the cooling surfaces if the air is at the same temperature."

Bob thought this over for a moment and then remarked, "I thought the intensely cold air at high altitudes would over-cool the engine rather than allow it to overheat. If it is around zero, then there should certainly be enough cooling effect to cool the largest engine."

"THAT'S not what I'm driving at," explained Ed. "I mean that heavy air near sea-level will have a greater cooling effect than thin air at the same temperature. As a matter of fact, the two effects of temperature and density tend to correct themselves automatically with a limited extent.

"The low temperature at high altitudes tends toward over-cooling while the decreasing density of the air offsets the effect to a certain extent and tends toward under-cooling. There might be a point where they would balance each other, although I doubt whether you will ever climb that far.

"If you reduce the pressure on water to almost a perfect vacuum, you can make water freeze itself at room temperature," said Ed. "If the pressure can be reduced so far that the water boils at 32 deg. F., then the water will literally boil itself into ice. If you went to high school or college, it is likely that you have seen this experiment performed with an instrument known as a 'cryophorous.'

"Yes," said Bob, "I remember that stunt now that you speak of it. It was a long stemmed vacuum tube containing water, and when one end was chilled, the water started boiling and then suddenly congealed into a mass of ice. In this case, they froze the ice without any cooling at all.

"How does the high altitude affect the power of the engine?" asked Bob. "I know that they use superchargers to jam the mixture into the cylinders, but the reason for it has escaped my memory since leaving the ground school."

"There are two general losses taking place in a gasoline engine at high altitudes. In the first place, the engine don't get the full weight of oxygen into its cylinders at each stroke as it does when near the ground. Since the mixture is forced into the cylinders by the atmospheric pressure, and this pressure is very low at high altitudes, the mixture doesn't flow into the cylinders fast enough to fill them. In the second place, a cylinder full of low density air doesn't contain a sufficient weight of oxygen to burn the proper amount of fuel, hence this automatically reduces the fuel charge and with it goes the power.

"Each pound of gasoline burned in the cylinders, to obtain a certain amount of power, calls for a definite weight of oxygen gas to burn it. If a cubic foot of this air is taken in at high altitude, its oxygen content by weight is so small that it will leave some of the gasoline unburned—unless the air is pumped into the cylinders by the supercharger. By pumping the air up to normal pressure, the air once more contains the proper amount of oxygen per cubic foot and the engine will develop its normal power. Is that clear?"

"If we should get up to an altitude where the air contains only a few

molecules per cubic inch, then an enormous volume of air would be required to burn the gasoline."

"A supercharger, therefore, is for the purpose of controlling the weight of oxygen gas taken into the cylinder, the amount of fuel burned, the velocity of the mixture into the cylinder and the compression pressure."

"I thought that the compression pressure depended entirely upon the compression ratio," said Bob. "If the piston jams the mixture into a small space, the compression will be high, whereas, if the space at the end of the stroke is larger, then the compression will be reduced. I don't see what else could affect the compression."

"Well, I'll be ———!" roared Ed. "Were the chairs so comfortable at the ground school that you slept all through the lectures, or have you just one of those slippery memories?"

Bob smiled sheepishly, and then remarked: "Well, I was never so good at this engine stuff anyway—and I guess I just didn't understand it fully."

"CERTAINLY, the compression ratio is a determining point in the compression pressure," said Ed with a glowering expression. "But there is also something else that is of as much importance, and that is, the weight of air drawn into the cylinder. If this engine were pulling in its charge from a partial vacuum, and then compressing it into the end of the cylinder, would you expect as high compression as you would get if the mixture were being forced into the engine?"

"No," admitted Bob. "I see the point now. If you had no air to compress you would get no pressure, no matter what the compression ratio was."

"Just so. It isn't the air volume that counts altogether. It's the total weight of the air that is taken into the cylinder on the suction stroke. The light thin air at high altitudes weighs less per cylinder-full than at lower altitudes, when the piston sucks it in alone and unaided. The lower compression also tends to reduce the power as rapidly as the other causes just mentioned. Thus, summing up, the altitude affects the weight of fuel burned and the compression pressure at the same time, so that every drop in pressure is accompanied by two distinct losses."

"Seems to me you are contradicting yourself, or something," said Bob. "Seems to me that you, or some other wise guy around here, made the crack that the mixture got richer at high altitudes or at least tended toward getting richer. It was something like that. If that's the case, why don't you get more power?"

"That was in the old times when carbureters were just kerosene cans and nothing else," came the answer. "The nozzles were not compensated for pressure variations. The result was, that the mixture got so rich at a few feet off the ground that the engine started smoking. This is not a contradiction, but confirms what I have just said. It is the old, old question of not getting enough oxygen.

"If the carbureter is not compensated for pressure variations, then the carbureter fuel nozzle will continue to supply the same amount of gasoline at a given pressure regardless of other conditions. If the air coming into this carbureter is at such a low pressure that it contains only a little oxygen, then the mixture becomes relatively richer. It is not because there is more gasoline, but for the reason that there is less oxygen to burn it, hence the rich mixture—and the smoke."

"What's the difference between aviation gasoline and the stuff that I burn in my flivver?" asked Bob. "Is it only the price or is there some real difference?"

"That's another smart question that makes me proud of you—not," yelled Ed. "What have you been doing to yourself this morning? You just try some of that bargain-counter gas in one of these engines and see what it will do. Do you think that we are suckers altogether or only once in a while?

"IN the first place, the compression of aviation engines is much higher than in automobile engines. This is necessary in order to get just as much power as possible out of every cubic inch of displacement. The engines also run much hotter than the automobile type, and that is another reason why the conditions are different."

Ed thought a moment and then continues. "There are all sorts of gasolines, some having high boiling points, while others boil at very much lower temperatures. The low boiling point gasolines are by far the more expensive because there is a lower percentage of them in the crude oil from which the gasoline is made. The cheap high boiling point gasolines do not work well under high compression. They "knock" or detonate badly, foul the spark plugs and produce a lot of sooty carbon in the cylinders.

"The low boiling point gasolines cost a whole lot more, but they start easier, produce less carbon, knock less and are all around the best for aviation engines. However, the compression ratio of some modern engines is so high that knocking takes place even with the high test gasolines, and for this reason we have Ethyl gasoline and the various other anti-knock types. A small amount of tetraethyl lead is mixed in with high test gasoline, and this is very effective in reducing detonations and similar troubles.

Then there are the so-called "aromatic" anti-knock fuels that are quite effective for moderately light compression pressures and temperatures.

"Well, I guess the rain is over, so you can start in and pile up some more time for that license you're always talking about. I'm going to turn you over to Mac, who'll hold the stopwatch on you. See you later."

Exploring the Stratosphere

The Junkers Stratospheric Plane.

ONE of the most daring and picturesque adventures in the history of aviation—an ascent in an immense balloon to a height of 15 or 16 miles above the earth's surface—is being planned in England by two brothers.

A few months ago, a Belgian professor startled the world by ascending nearly ten miles, using a large balloon from which was suspended a hermetically sealed aluminum sphere. Within that ball of metal, the professor and his assistant rose at an astonishing speed to that region of intensely rarefied upper air styled the "stratosphere."

This lies far above the surface of the globe and the breakable lower layers of the atmosphere. Physicists, and particularly the weather experts, believe that much may be learned by the study of conditions prevailing in the stratosphere.

Numbers of tiny "observation" balloons, carrying recording instruments, have been sent aloft in efforts to discover what goes on so far above the earth. Now man himself is beginning purposeful exploration of the upper air.

The two British high-altitude explorers, Eustace and Oswald Short, began building airplanes as far back as 1909. Since then, their firm has gained a world-wide reputation in the design and construction of many types of flying machines.

Their large flying boats have been particularly successful, including the three-engined "Calcutta" boats used by the Royal Air Force and Imperial Airways, and the new four-engined "Kent" air liners which rank among the largest passenger-carrying marine aircraft yet placed in service anywhere in the world.

They are, therefore, eminently fitted for the task of constructing a balloon, which in capacity will be the largest ever built. Also the still more difficult

(*Continued on page* 123)

XUM

New Ideas for Our Model Builders

Model Airplane for the Radiator

Airplane Model Mounted on the Radiator of a Pontiac Car.

AN INTERESTING yet simple radiator-cap ornament, consists of a small model airplane that rises up a vertical rod, the motive power being provided by the air currents set up by a moving automobile. Roughly, it is also an air-speed meter in addition to being an ornament.

If you do not already have a small toy plane, whose overall length is about 7 in., you can purchase or make one. The type is not important if the model is equipped with wings that exert a lift when forced rapidly through the air. The plane shown in the photograph is constructed of soft pine and gum, and while it is comparatively heavy; yet it rises at an air-speed of about 30 miles an hour.

Obtain a length of metal rod or tubing about 20 in. long and mount it securely in an upright position on the radiator cap or some other part of the car. If you dislike attachments that might divert the driver's attention, place the plane where it will not be in the direct line of vision. The manner of attaching the rod will be governed by local conditions.

Through the fuselage of the plane, at the balancing point, drill a hole slightly larger than the rod. Slant this hole so that the wings will be tilted upward at a slight angle. A little grease or oil in the hole will make the plane rise more easily. If it remains at the bottom of the rod, instead of flying, decrease the weight or increase the wing area after first making sure that the hole is not so small that it binds the rod.

Model Sikorsky Used on Sign

A View of the Model Sikorsky.

PHILIP HATTON, West Palm Beach, Fla., is the proud constructor of the Sikorsky S-38 shown herewith. This is a non-flying scale model built for the Roosevelt Air-Base to be used on their signboard. It is scaled down from the original ship and has a 58 inch span. It was built around bulkheads with the whole framework covered by veneer.

As will be seen, this is an excellent piece of work and greatly to be admired, particularly when we consider that the age of its builder is only 15 years. It is painted in the Roosevelt colors with a blue and black hull, yellow wings and white script lettering.

This calls to mind that models of this sort could be made a source of income.

Builds Model of the Akron

IN VIEW of the great amount of publicity given to the navy's new dirigible, the "Akron," it seems strange that so few model builders have attempted the construction of dirigible models. However, Henry Projansky, 643 Beach St., Revere, Mass., has undertaken the construction of an Akron model, and as the accompanying photograph shows, has made a very creditable job of it.

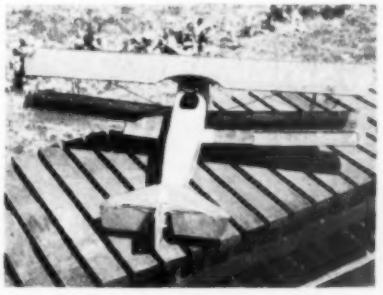
This model is eight feet long, and is built accurately to scale in every particular, no small job when we consider the difficulty of obtaining the correct outline of the hull and the multitude of small parts that comprise the power plants and controls. Our ambitious model builders, looking for new worlds to conquer, should start in on dirigible models.

This Eight-Foot Model of the Akron Is Very True to Life.

A Fleet Model Proves Attractive

THIS Fleet model, complete in every detail was built by one of the P. A. family of readers whose last name is Ramsey. Sorry we cannot give you his name and address, but Ramsey neglected to give us this information. Who are you, Ramsey, and where?

Anyhow, it's a mighty fine looking model and particularly attractive since it is a biplane. Most model builders seem to favor monoplanes entirely. Too bad that there are not more of you fellows who will tackle an O. C. trainer instead of the warplanes and racers that are the fashion at present.



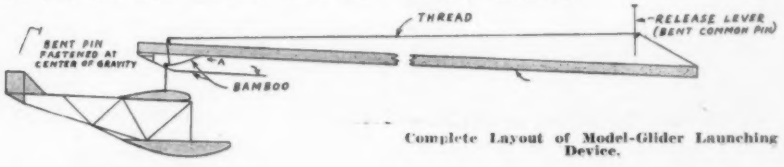
A View of the Fleet Model.

A Clever Device for Launching Model Gliders

ONE of our glider readers, R. E. Hall, devised a new method of launching gliders while confined to his home by illness.

This method is shown by the accompanying diagram. When the thread is pulled, the bamboo trip (A) is raised, permitting the glider to slide down the rod (B) and into the air. This undoubtedly is effective in securing longer and better glides.

Gliders launched from the hand are uncertainly launched, because we are unable to judge the angle accurately at the instant that the model leaves our hand. If the angle is too steep or too shallow, then the glider loses distance or duration.



Complete Layout of Model-Glider Launching Device.

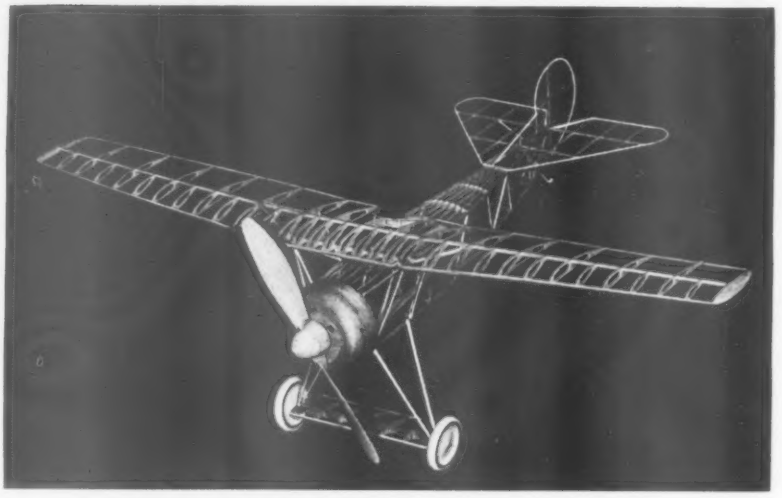
XUM

MODEL DEPARTMENT

HOW to Build the Fokker Monoplane

by

JOSEPH S. OTT



Frame of completed Fokker D-VIII monoplane without covering.

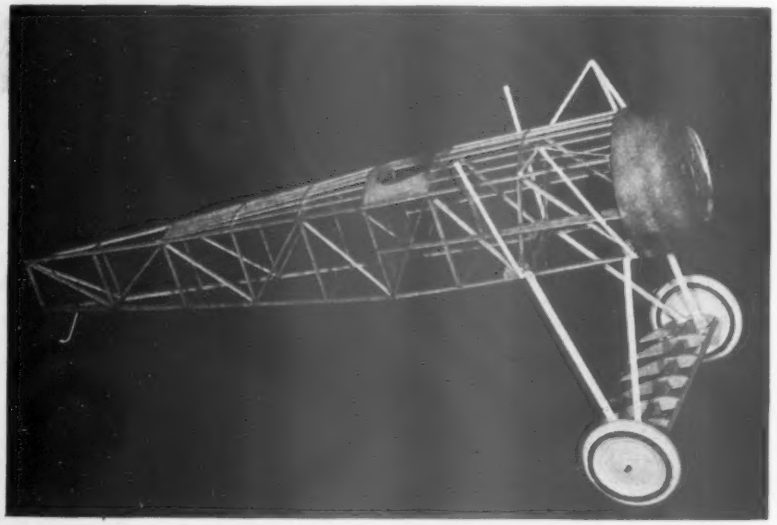
HERE is a model of a ship that was designed for use in the World War, but which never actually reached the front for war service. Designed for the German Imperial Flying Corps, this Fokker D-VIII was considered one of the best designs presented for use as a flying pursuit plane.

The original models were prepared and ready for delivery a year before the war ended, but it was impossible to convince the General Staff of the Germany Army that a high wing full cantilever monoplane was practical for fighting purposes. At the time that this model was approved it was too late to be brought into actual use.

I am indebted to Captain Reeves, U. S. Army Air Corps, for sending me photographs and drawings of the original D-VIII. This design is approximately thirteen years old, but at the same time it does not appear to be the type of design that would be put into the files and be forgotten as something antiquated.

Four photographs of the model are shown in various stages of construction so that the builder may have the full benefit of the various arrangements when working on the model. From the small drawing, a full size view of the side of the body should be laid out so that work may be done directly on the drawing. The wing being a full cantilever, is tapered both in thickness and in length. Full detailed explanation for laying out the wing is given under that heading.

The photographs of this plane show the 45-inch model. The complete weight finished with covering, decorations, motor stick, etc., is 5¼ ounces. It is not necessary to make a model of this wing span. The cost is governed by the size and the amount increases rapidly as the plane becomes larger. The most economical size is the 15-inch wing span model on which the cost averages from $1.00 to $1.50. The 24 to 30-inch models average from $2.00 to $3.50, and the 45-inch model will average between $4.00 and $6.00.



Details of fuselage and landing gear structure.

ABBREVIATED BUILDING INSTRUCTIONS

1. Body—left and right sides.
2. Nose cowl—solid or built-up.
3. Landing gear struts.
4. Axle (small wing).
5. Shock absorbing bamboo axle.
6. Tail skid.
7. Stabilizer.
8. Rudder.
9. Ribs—tapered nose.
10. Wing.
11. Eye-hooks.
12. Wing struts—"S" hooks.
13. Propeller—Nose spinner.
14. Motor Stick-fittings.
15. Covering—body, rudder, stabilizer and wing.
16. Shrinking—coverings with water.
17. Decorating—Insignias—German crosses.
18. Balancing.
19. Flying.

LIST OF MATERIALS

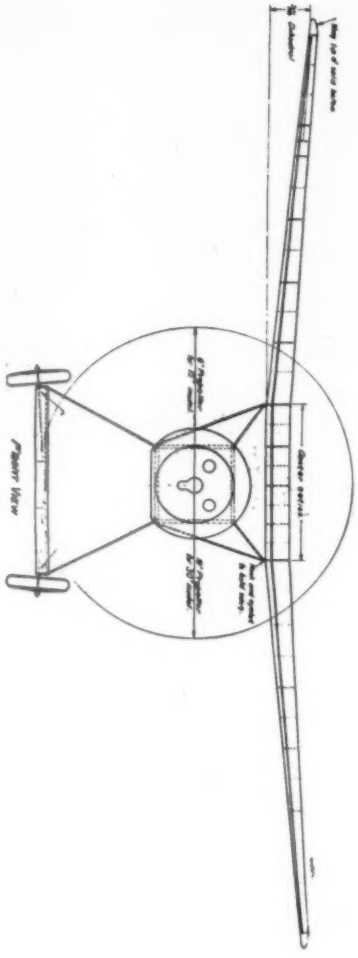
1. Bamboo—for landing gear and tail parts.
2. Balsa—10 pieces ⅛″ square by 30″ long.
3. Wheels—1⅜″ for 15″ model, 2″ for 30″ model and 3″ for 45″ model.
4. Rib stock—1/16″x2″, ½″x30″. Firm wood is recommended. For 15″ and 24″ models use 1/32″ thick material.
5. Fittings—all made of tinned piano wire, .022″ for models under 24″. Larger models, .032″.
6. Motor Stick—3/16″x5/16″. Pine.
7. Propeller—in proportion to the size of the model. 15″ model uses 6″ diameter. 24″ model uses 8″ diameter. 30″ model uses 10″ diameter. 45″ model uses 13″ diameter.
8. Motor—rubber—30 gauge by ⅛″.
9. Spars—⅛″x¼″ for the 45″ model. 1/16″x3/16″ for the 24″ model.

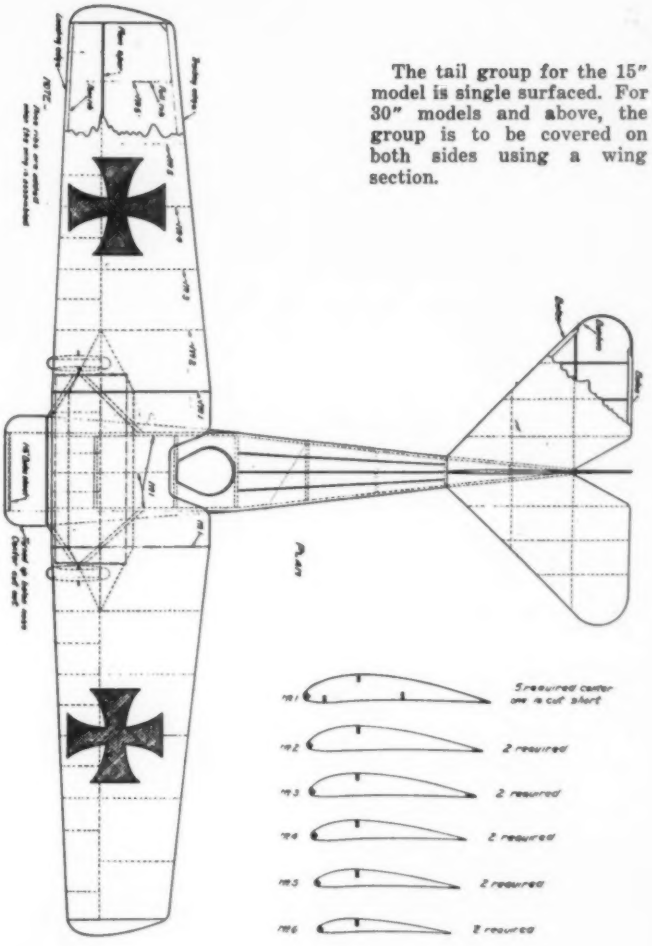
(*Continued on page* 116)

XUM

The Fokker D-VIII Monoplane

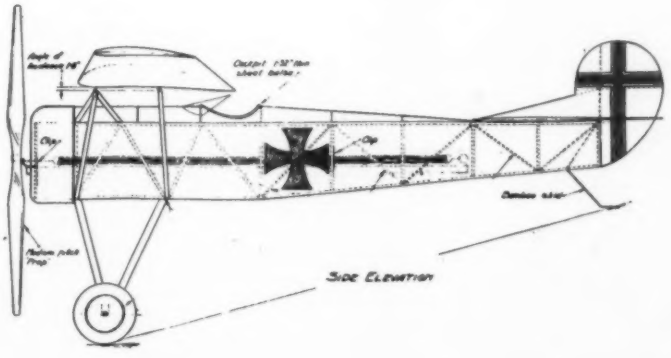
A Flying Scale Model





The tail group for the 15" model is single surfaced. For 30" models and above, the group is to be covered on both sides using a wing section.

Inclined struts behind the cockpit are to be half as thick as wide. The ends of the landing gear struts are to be bent under the fuselage for about half its width for strength.



Model Department

(*Continued from page* 114)

10. Trailing edge—1/16"x¼".
11. Entering edge—⅛"x⅛".
12. Tissue—Hokane.
13. Insignias—4 German crosses.
14. Cement—½ ounce.
15. Dope—1 ounce.
16. Lacquer—Red, ½ ounce. Black. ½ ounce.

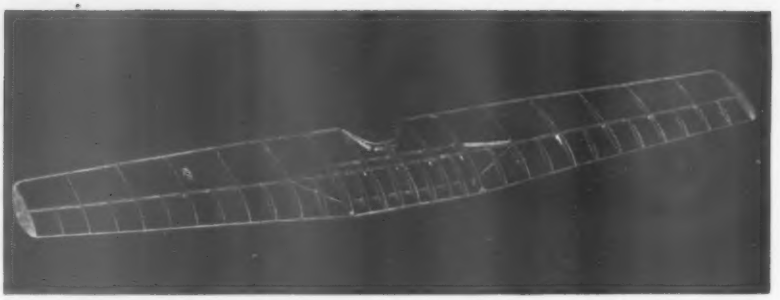
Body—No. 1

Full size drawings of the body, side and top should be made. Work with the material directly on the large outline. Pin down the upper and lower longerons. Pin in place over the drawing and cut an upright piece to fit.

After one side is completely finished and dried, remove all the pins and lay a waxed tissue sheet over the entire side. Build a duplicate on top of the waxed sheet. This gives two sides that should be exactly alike. After these parts are dry, they may be assembled by cementing cross-pieces above and below in the fuselage.

Nose Cowl—No. 2

The nose cowl may be turned out from a solid piece of balsa, cutting away the center part so that the motor stick may be inserted. The solid nose makes the model a little bit heavier, but gives just sufficient weight, balances the tail parts and brings the wing forward far enough to give a scale reproduction. If the nose is built up from pieces, and mounted on rings made of balsa wood, sufficient weight should be added so that the proper balance is secured.



The completed but uncovered wing structure of the Fokker D-VIII.

Landing Gear—No. 3

The landing gear is built of solid bamboo. The thickness should not be over 1/32 inch and the width of the strut will vary according to the size of the model under construction. One-eighth inch wide is suitable for models having a wing span of 24 inches or less; 3/16 inch wide, up to ¼ inch for 30 and 45 inch wing spans. When cementing landing gear to the body, do not make the butt joint bend. The smaller part is approximately ½ inch long. Cement this part to the lower part of the fuselage strut.

Axle—No. 4

The landing gear struts are cemented to the axle, which in turn is streamlined by the small wing built over the entire unit.

Absorbing Bamboo Axle—No. 5

The spar used on the small wing is hollow and the axle, made of bamboo. is cemented in the center of this spar, being bent so that the ends are on the lower upright side. After the wheels are attached, the height of the hollow spar is the distance that the axle can move up and down. Allow a limited amount of shock, but sufficient to take sudden jolts away from the model.

Tail Skid—No. 6

The tail skid is made of bamboo and is anchored securely to the rear end of the model. The lower section is filled up with thin balsa, and the skid continues through and up to the top longerons.

Stabilizer—No. 7

The stabilizer for small models, under 24 inch wing span, is built-up and covered only on one side. The outline, wherever straight, is made of balsa. The round parts are added, using bamboo. Bamboo may be employed entirely if desired, making each side in one piece. On the larger models the stabilizer should be a streamlined wing section and covered on both sides. The thickness of the stabilizer should not exceed ¼ inch.

Rudder—No. 8

The construction of the rudder should be similar to that of the stabilizer for the small or larger models.

Tapered Ribs—No. 9

Building the ribs for this model will be quite a job. After deciding upon the size of the model wanted, the top view of half of the wing should be drawn out to full size scale. The top view will show and give the exact length of each rib as required. Now proceed and make a front view drawing of the wing.

Check over the thickness at the center and at the tip. After the lines have been drawn, representing the top and the lower side of the wing, the depth of each rib may be measured at their respective positions. After the ribs have been completed, and are assembled into the wing, the nose ribs are made to fit as required between each rib. These help to maintain an even contour of the wing section.

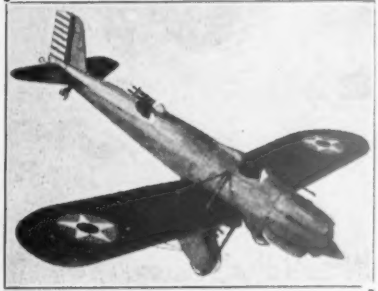
Wing—No. 10

For the smaller models, the ribs need not be cut out and lightened. The center section of the wing and the left and right sides may be built up separately. At all times, when assembling the wing, work on a flat surface. The use of a drawing board makes a handy, smooth and flat surface.

After both the left and right sides are completed, they are assembled to the center-section. At this time include the correct amount of dihedral. Where the wing is cemented at the center-section it is necessary to use a butt-joint. To strengthen this part, cement small corner pieces around the spars. This is clearly illustrated in the photographs of the wing.

(*Continued on page* 118)

Pioneer!



Snarling Death!

Uncle's Sams most vicious battle plane—the new Curtiss A-8 Attack plane. Each plane is armed with six machine guns, a Cargo of bombs, and a speed of almost 200 m.p.h. A squadron of eighteen of them is called equal to the artillery and machine gun fire of a division of 30,000 men.

Pioneer's flying model of this new ship is accurately to scale, 1/20 the size of the actual ship, and carries full battle equipment of six guns and bombs, the bombs dropping in flight. Model weighs 1.5 oz. 26 -in. span, duration 90 seconds. Prop, cowlings, pants and all difficult parts blanked out, all materials to dimensions metal fittings formed, celluloid wheels, insignia, cement, full size layouts and ample instructions. Be one of the very first to get this newest of Pioneer models. Kit postpaid only..... $2.00

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De HAVILAND-4 BATTLE PLANE

(Not recommended for beginners)

THE famous prototype of this keen little ¾-inch scale Cleveland-Designed model is now in the Smithsonian Institute in Washington, D. C. This design was known during war days as "The Flaming Coffin." A famous plane—and every model enthusiast who builds this Kit will thrill to the many warlike accoutrements duplicated on the Cleveland-Designed model, such as bombs, guns, etc. Span 31¾-inch; length 22¼-inch; weight 3.9 oz. Colored all yellow with black equipment and trimmings. Complete kit **SF-3**, only **$3.50** postfree. (Special Delivery, 15c extra.)

THE POLISH P. 6. FIGHTER

THIS strikingly unusual Cleveland-Designed model, realistically pictured here superimposed on a cloud background, has already proved a marked sensation in the model airplane world. The awe-inspiring prototype is the one with which Capt. Boleslaw Orlinski, Poland's famous airman, astonished the crowds at the 1931 National Air Races. Incidentally, it is said that this plane has the highest performance of any military plane. The model is a dandy flier with lots of speed. Span 25½ inches, length 17½ inches, weight 2.7 oz. Colored entirely yellow, details black, red and white Polish insignia and fuselage bands supplied. Turned hollowed out balsa engine end ring supplied. Complete kit **SF-6**, only **$2.95** postfree. (Special delivery 15c extra.)

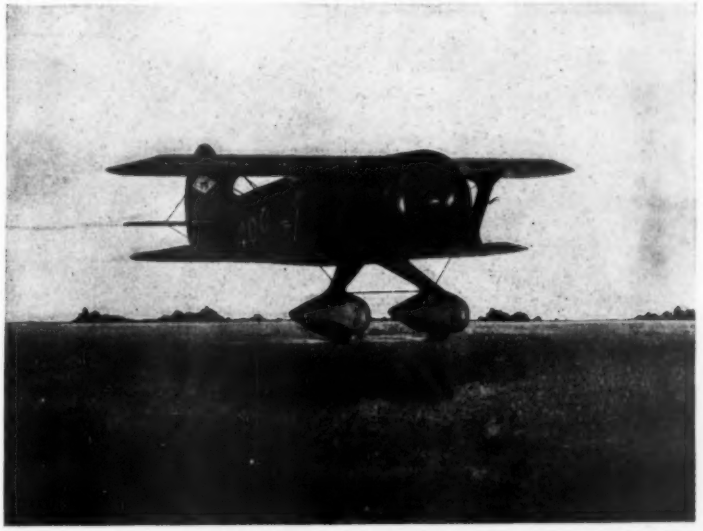
All pictures on this page are of Cleveland-Designed models—not the big ships they represent.

Famous GREAT LAKES SPORT TRAINER

THIS internationally popular Cleveland-Designed ¾-inch scale model of the ship flown by Tex Rankin when he startled the world with a daring performance of 34 consecutive outside loops, has an unofficial flight record of 3,608 feet—almost ¾ of a mile—this record has never been beaten. A great flying model, and unusually interesting to build. Span 20 inches; length 15¼ inches; weight 1.2 oz. Colored orange wings; black tail surfaces, scalloped with orange; black fuselage with orange panels; black details. Originally sold for $5.50—now less than half that. Complete kit **SF-1**, only **$2.50** postfree. (Special Delivery, 15c extra.)

SE-5 (SOPWITH EXPERIMENTAL-5)

FLOWN in 1918 by many pilots in the British Air Forces—(better known as the RAF). An extremely interesting ship to model, particularly since the ¾ inch scale Cleveland-Designed model has carried out so many authentic details, such as the realistic radiator—machine gun hole n'all, dummy motor, long exhaust tubes, Lewis machine gun, windshield headrest, etc. Span 20 inches; length 15¾ inches; weight 1.9 oz. Colored natural or ivory; black struts and details. Complete kit **SF-9**, only **$2.25** postfree. (Special delivery 15c extra.)



Sensational LAIRD SUPER-SOLUTION

POPULAR Major "Jimmy" Doolittle's cross-country record-smasher! Jimmy, as you remember, burnt up the air in tearing from the West Coast to the East in less than half-a-day—faster than it has even been done before. The above picture is not his ship—believe it or not—but the ¾-inch scale Cleveland-Designed model superimposed on a field background. Sure looks real, doesn't it? Everybody wants this great little model—with its zippy flight and clean, trim powerful looks. And does it fly?—Our tests showed it flew about 35 m.p.h. in flights covering over 500 feet of ground. Span 15½ inches; length 13¼ inches; weight 1.7 oz. Colored yellow wings, stabilizer and elevators; green fuselage, fin, rudder and struts; black details. Wheel shoes characteristically touched with the yellow design. Comes complete with turned balsa cowl front and at a price everyone can afford. Complete kit **SF-5** only **$2.50** postfree. (Special delivery, 15c extra.)

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XUM

WOMEN'S ACTIVITIES
Edited by Lady Mary Heath

Miss Maud Tait, who is making a name for herself in speed circles, obtained a license to marry James Moriarty of Springfield, Mass. A honeymoon in the West Indies is planned after the marriage.

* * *

Lady Mary Heath.

Mrs. W. Irving Tier successfully averted a bad crash at Roosevelt Field on December 8, when taking the tests for her transport license. In one of the necessary maneuvers, a four turn spin, her plane failed to recover itself while Mrs. Tier was flying at a height of 3,500 feet.

Unable to free herself from the cockpit, because of the centrifugal force of the spin, she settled back into her seat and worked the controls. As the plane descended to 1,000 feet, the nose dropped and its speed increased in its whirling dive.

A second later, at 800 feet, it finally responded to the controls, and Mrs. Tier brought it out of the spin into a straight power dive. She made a safe landing, but the remainder of the test was put off for a few days because of the shock to Mrs. Tier's nerves.

* * *

German women pilots are busy going places. Fraulein Elli Beinhorn arrived at Istanbul from Sofia on December 7, on one leg of an air tour.

The London Aeroplane Club reports that women fliers among its membership are taking more and more interest in the mechanical side of piloting. A great many are now to be found in the shops of the club, working on machines and engines as a preliminary step to starting their pilot's training.

* * *

Mrs. Grover Loening and Mrs. R. D. Huntington are among the women who have recently received their licenses. Both are members of the Long Island Aviation Country Club.

* * *

Ruth Stewart is planning to make a non-stop flight to Buenos Aires. She is expected to leave from Floyd Bennett Field. Miss Stewart flies a Lockheed.

* * *

Mrs. Mary Alexander, widow, of Lynchburg, Va., is said to be the only flying grandmother in the world.

* * *

Miss Mary W. Nicholson, of Greensboro, N. C., is the only woman pilot of that state. Miss Nicholson holds a private license.

* * *

Jessamine (Tiny) Goddard won the Barrier Landing Contest at the Aviation Country Club meet, competing against ten men. She also took second place in the 125 h.p. race. Miss Goddard is flying a Warner Monosport. Betty Gillies took second place in the spot landing contest, and Mrs. Gillies and her husband took first in the comedy race.

Frances Harrell Marsalis and William Marsalis, her husband, are operating the Empire Flying Service, which they have established at the Floyd Bennett Field. Fay Gillis, who recently returned from Russia, is head saleswoman.

* * *

Joyce Hartung, 16 months old, is given credit for being the youngest of fliers. Joyce spends many hours in the air and has her own flying outfit and parachute. Her father and mother are both pilots. Women fliers will know her mother as Mrs. Gladys Hartung of Detroit.

* * *

Mrs. Frank Tichenor recently christened a new machine at the airport at North Beach, Long Island.

Model Department

(*Continued from page* 116)

Eye-Hooks—No. 11

The wing is held into position, over the body and against the struts, which have small eyes and hooks, allowing the wing to be released as desired. These may be bent from piano wire .016 inch in diameter.

Wing Struts—No. 12

The body should be set up in position, and the wing struts, which are made of bamboo, fitted temporarily in position. The left and right sides, when completely assembled and cemented in place, must be of the same height. Variations in length may be covered by assembling the top ends after the lower ends have dried in place. The "S" hooks are cemented to the top part of the struts. Before finally cementing in position, check back by putting the wing in its proper place.

Propeller and Nose Spinner—No. 13

The diameter of the propeller is governed by the size of the model under construction. To improve the appearance the nose spinner may be added to the center of the propeller. The nose spinner may be cut from a solid piece of wood with a slot directly in the center, which fits over the propeller hub.

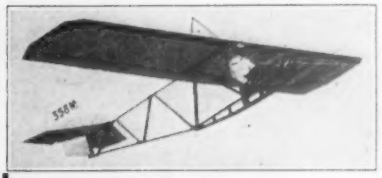
Motor Stick—No. 14

The motor-stick may be made from pine or bass, so that the over-all dimensions are held down to the minimum. For the small models balsa wood is suitable. The propeller-bearing and the rubber hooks should be put on before fitting the stick in the body.

Attach the propeller and place the rubber strands on the stick, so that sufficient room is allowed while fitting the motor stick into the body. The circular piece of balsa is added into the hollow of the nose, to which is attached the motor stick clip. The rear of the motor stick is held in place by a wire clip attached to the upright of the fuselage members.

Covering—No. 15

The body is the easiest part and should be covered first. The rudder and stabilizer may be covered com-



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pletely and then cemented in position on the fuselage. The wing should be covered in sections and care must be taken so that it is not warped out of line by pulling too much on one corner.

Shrinking—No. 16

To pull the covering taut, use a fine sprayer and spray the complete model with water, allowing it to dry gradually. The complete wing should be attached to a large, smooth surface and held temporarily in true form until the tissue is dry. Allow the wing to remain in its set up position for about an hour.

Decorating—No. 17

The decorations, of course, should correspond as nearly as possible to those on the original full size machine. The crosses, placed on both sides of the body, should be the type of cross used toward the latter part of the war. This was a cross with straight arms, outlined with a white stripe. The vertical rudder was light blue with black cross. According to photographs, the engine cowl was polished aluminum.

Balancing—No. 18

If the solid nose-block has been used, very little trouble should be had in balancing the model. The length of the motor-stick in many cases will help to correct fore-and-aft balancing. It is best to balance the model without the motor-stick so that it has a good gliding angle and then maintain this position of balance with the motor-stick in place. In case a built-up nose is used on the model, add sufficient weight. Small pieces of lead are suitable, cementing them to the lower side.

Flying—No. 19

Before flying the completed model it is always best to make complete tests by gliding. The assistance of some friend might be necessary so that no damage is done until everything has been set and the model maintains flying stability.

In some cases it is necessary to try two or three propellers, having different pitches, so that the speed will be close to the gliding angle, which should help to maintain longitudinal stability and prevent sudden dives and zooms.

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Principles of Soaring

(*Continued from page* 107)

pounds tensile strength and from three hundred up to eight hundred feet length is used.

One end of this cable is anchored firmly to the ground for a distance of almost its own length and in front of the sailplane. Then the cable is run over a pulley of 10 inches diameter, and then back to the nose-hook on the plane. The pulley is fastened either to the rear of an automobile if there is enough runway or to the center ring of a shockcord.

AT LEAST twenty boys should pull the shockcord for such a start. With a forward motion of the pulley, of about twenty miles an hour, the glider will have to travel just twice as fast as without the pulley, and will climb quickly with excess flying speed. The pilot is to release the steel cable from the nosehook of the plane when over the anchor point of the cable on the ground, which, for this reason, should be marked by a white flag.

For the first few years of actual soaring flight, only the slope upwinds had been used consciously. In the year 1926, the importance of the thermal upcurrents was gradually discovered. A soaring pilot of today, unless he has been sailing with the clouds, is not considered up-to-date.

These vertical moving thermal or convectional air currents are started by the unequal heating of the ground and the atmosphere. The air is not heated directly by the sunrays but indirectly by the heat reflection from the ground. Warm air always must rise. The warm air rises above a stove as well as the warm air above a cornfield, in the bright sunlight.

For instance, a fresh plowed dark field will swallow all the heat it can get and will leave the air above it cold. Water, swamps, woods, and marsh will absorb heat during the daytime, while light colored ground, like rocks, pastures, cornfields and sand, will reflect the heat and create upwind currents. However, these conditions reverse after sunset.

The woods, swamps and all the dark spots, which were more economical in absorbing the heat during the day, radiate this heat in the evening and thereby provide the most excellent upcurrents. These effects are not as well recognized in the more stable currents in wintertime, but a hot summerday often may bring many surprises in this respect.

In the late afternoon, between 5 and 7 o'clock, is the time at which this change takes place. The change is always malicious and not liked by soaring pilots on distance flights. The most favorable time to start out for a motorless distance flight, on which the slope upwind and thermal upcurrents are to be used, is around noon.

(*Continued on page* 124)

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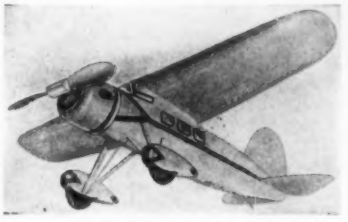

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XUM

Qualifications of a "Big-Time" Pilot

(*Continued from page* 82)

This is the Air Ferries line, flying from Alameda to San Francisco, Calif. The ship leaves the San Francisco Bay Airdrome at Alameda, which is a well kept hard packed field. It lands on San Francisco Bay close to the Ferry building, in a nice bunch of wet water.

When the pilot leaves the Alameda field, he rolls up his landing gear and gets ready for the water landing on the San Francisco side of the bay. If he lands in the water with his wheels down, he has a good chance of joining the great army of the unemployed while his ship becomes a playmate for the little crabs, clams and what have you on the bottom of the bay.

If only the reader could see one of these big Loening ships scoot across the bay under a low ceiling, ducking ferry boats, tug boats and everything else that floats around on the bay! And finally, it splashes into the bay and runs up on its ramp, dripping with water like a big fat duck.

THE trip takes six minutes from take-off to landing. In that six minutes, the pilot must get his wheels up or down as the case may be, scoot around ferry boats—and the bay is full of them—keeping an eye peeled for two long piers that stick way out into the bay.

Last, but not least, he must look out for a large island, located right smack in his way. The government wouldn't like to have this island moved, because they intend to build an airport on it some day, and if Vic ever hit that island they wouldn't need an airport.

Then, again, the boy would be very much embarrassed if he landed at Alameda with the landing gear up. Which brings to mind another story. A young man applied for a job on the line one day, and as they were short of pilots at that time, they gave him a chance to show what he could do. He had Loening experience in the army and from his conversation one would judge that he was uncle, nephew, father and grandfather of the gink who started the flying racket.

Well, to make a long story short, this bird left the Alameda side with a load of passengers. He took-off pretty, and in a very few minutes he was back again after dropping his load on the San Francisco side. He circled the field and came in for his landing.

The company officials were waiting for him, and I guess the boy was excited. He put that ship down on a one point landing, and it skidded along on its belly, finally coming to rest on one wing. When this young Man climbed out of that ship his face was trying to compete with a good sunset. Someone of the officials gave him the old "thumbs down,"

THE above yarn should give some of you youngsters, in this man's game, a little idea of the big time job of flying. If we just get into your cranium, the thought that the present crop of flyers can't last forever, we will have accomplished something. Keep your eyes on the big planes—and be sure your best eye is forward.

One other little thing might interest you—and that is salary. You may wonder if the job of big time flying is worth the effort. Of course, I have no idea what you would consider a good salary, but if seven hundred to one thousand dollars a month would interest you, that's that. They sometimes go well over this amount, but seldom below it for a good pilot. Now, a little comparison might help you to decide.

From a reliable source, the writer has obtained the following information. A sea captain, on one of our really big boats, receives from four to six hundred dollars a month. This takes him about twenty years to build up a reputation. The captain works day and night—not from two to four hours a day. The captain probably studied for ten years before he ever had an officer's rating. One thing holds true, both on the sea and in the air—one crack-up and you're OUT.

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I just found 150 little propellers. They cost $12 to make. I bought them cheap. Now you can buy these real walnut propellers 15 inches long for 95c. All new and shiny. Mount a clock in the hub. Make an ash tray out of one! A nice paper weight or ornament for your desk or wall! Send me 95c plus 15c postage today and mail it right away as I have only 150 of them and I know that they won't last very long.

KARL ORT, 614 W. Poplar St., York, Pa.

Early Birdling

(*Continued from page* 96)

he interpreted that to mean at once, and so announced to the crowd.

It was too late to do anything with that wild gang of spectators but fly. I agreed, if the manager would get a doctor in a motor car out to a designated point on the field, that I would start.

There was a ridge about three hundred yards from where the machine was being held down on the ground by my men. It was this ridge that worried me. I knew that there would be a violent swirl of the air over the ridge, with a down draft on the side nearest to where we were. Once high enough to clear the bad air, it might have been possible to fly straight into the wind for a mile or two before landing, but if caught in this swirl there was nothing in store for me but a nasty crash.

The seriousness of the situation finally dawned upon the manager, but by that time nothing would have stayed the mob. They would have torn up the machine, local managers and everything in sight.

The plane left the ground almost as soon as released by the mechanics—the flight was on. It took all the controls and everything I had to keep right side up before the ridge was reached—the machine literally shuddered. The box-kite front elevator went into the up-draft and the flight was over. The nose of the machine shot straight up. A blast of wind struck the left wing from below, blowing the machine backwards like a sheet of paper, landing in a heap with me in the wreckage.

A strange thing happened in the moment of that wreck when I struck the ground. The impact made me grunt, and as blackness enveloped everything, a vision of the past appeared before me.

An episode which had taken place many years before reappeared. A duck which I had shot on the wing, landed at my feet and expired with a grunt—just such a grunt as had escaped from me when I struck the ground. My feathered friends need have no further fear of my disturbing their flights. I will never shoot another bird on the wing.

* * *

FLYING at Mexico City produced a couple of thrills not to be forgotten. The flying field there is some seven thousand four hundred above sealevel. To get an old type, single surfaced, fifty horsepower plane into the air from such an altitude was a feat in itself. Knowing this, I felt it was desirable to make a test flight on the afternoon before the meet opened to the public.

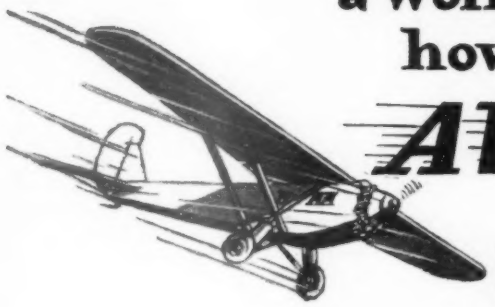
After a run, to which it seemed there would be no end and over a none too smooth field, the machine was coaxed into the air. There was not a pound of reserve buoyancy. Another

(*Continued on page* 129)

XUM

In this FREE BOOK

a World-Famous Flier shows how *YOU* can get into AVIATION



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Prop in the Way

(*Continued from page 98*)

I picked up my bloody leg, as best I could, and waved it at him.

He didn't even stop to shut the switch, but started under the fuselage —then went back and cut it.

All this takes so much longer in the telling than it did in the happening. It was only seconds, though I have often wondered if Ted hadn't realized that something was amiss—with the shattered prop jerking at the engine the way it was. Very likely he did, and was trying to locate the trouble when he saw me.

How he got all five feet seven inches of me over the three-strand barbed-wire fence and into the coupe, we don't know. All I could think of was that splintered prop, which I had seen as he carried me past it. And that was all I talked about during the two-mile ride to town!

Well, Ted was grounded for six months for "neglect of duty"; my leg was shattered above the ankle and broken four inches below the knee. This kept me in the hospital eight weeks. Both blades of the prop were splintered to the hub, and the trip to California had to be postponed.

I say postponed, but never for one minute did I give up the thought of going. Most persons might have had enough aviation for a while—but not I. It was five weeks after I left the hospital before I could get around a little on crutches, but as soon as I could manage them, I announced—much to my dear doctor's horror—that I was leaving for California the following day. Ted had permission to fly the ship home; it was ready to take the air again, and so was I.

The trip was very like any cross-country trip must be. Most of it was uneventful, though there were moments of anxiety and a few real thrills. Part of the fun was watching the faces of the men at the airports when I climbed out of the cock-pit with a big white cast, crutches and all—to be lifted down from the wing.

Three are the things I learned—beware of the back end of a mule and the front end of an airplane. It doesn't pay to be "helpful" unless you know what you are doing. And the last—if you once get aviation into your system, you can't get it out.

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Bert White

(*Continued from page 86*)

height. We know there is static electricity up there and we know that silk and electricity do not get along well together. Major Macready, for instance, felt that because of the extreme lightness of the air five miles up, that a jumper coming out of a plane would drop so quickly that an electrical spark *might* be produced and that this spark *might* ignite the silken 'chute. Others thought that the bag wouldn't open.

Well, *now* I know and they know. If the 'chute had produced a spark and ignited, *they* would know. From this jump we found out that there is quite enough air resistance to open the 'chute and let the jumper down safely and even gently.

There is another angle to it. We did not know what effect a jump from that height would have upon the jumper. Now we know. Of course, as I have said, it knocked me out when I ran out of oxygen, but at the lower level I came out of it and there were no bad after-effects.

After returning to the airport, I said a few words into the microphone, skinned out of my heavy togs and then proceeded to finish my afternoon's job of refereeing the other parachute jumps —a job I have had at all four national air races. I have been chairman of the contest committee each time and have refereed the jumps since the first races at Los Angeles.

They gave me a thorough medical examination and said there wasn't a thing wrong with me. The next day I had a flat feeling about the chest, but another good night's sleep and it had entirely disappeared. So that was something else we learned from the jump.

The other jump I made for a world's record that stood until the recent one, lacked but fifty feet of ending in disaster. I had gone up with Colonel Roscoe Turner and at 24,800 feet I bailed out. The first thing that happened was rather disconcerting, to say the least. When I dived out, the wind caught under the wrist of one of my gauntlets and the darn thing blew off. My hand froze stiff as a poker. And when I landed, I looked around and discovered that I had come down within fifty feet of a 50,000-volt power line. But a miss is as good as a mile even in parachute jumping.

A lot of folks have asked me how I ever got into this parachute-jumping game, anyway. Well, I supposed I just jumped into it.

I was studying medicine at George Washington university in 1925. The army aviation base was at Washington, and I was always going out there —watching the ships taking off and landing. It fascinated me tremendously.

Pretty soon I got an appointment as a cadet in the Air Corps and they sent me out to Brooks Field at San Antonio, Texas. I had six months of it and figured I was a first class aviator. So I bought myself a rundown Ford and hit out for California and Hollywood. The first place I went was to the Caddo Company's studios where they were engaged in filming the picture called "Wings."

I got an introduction to Howard Hughes, the twenty-one-year-old producer, and as Howard didn't know much about aviation, he gave me a job and put me on the payroll. My work was to scout around and find obsolete ships to be used in making war pictures and others in which old type ships were to be used.

Then, for a while, I did research and technical work, including such stuff as studying the lighting, sound effects and other problems involving the actual filming. We spent fourteen months on "Hell's Angels" and during the time I was getting more and more into the stunting game, and was doing various stunts around the different airports in the neighborhood of Los Angeles.

One of these I particularly remember. It was my closest call. I was hanging by my teeth to a rope ladder swinging eighteen feet below the plane. Ben Lyons was in a ship near us. Suddenly our ship began to lose altitude.

Four hundred feet from the ground I jumped. I had never before worn a parachute. It happened, however, thank my stars, that I had one on that afternoon. I turned loose, dropped, jerked my rip-cord, she opened fast and I struck like a plummet in the oozy mud of a swamp. The mud went over my boot-tops but I wasn't hurt. On that day I developed a sound affection for parachutes.

Then I began doubling for movie stars, and in that work I did some perilous stuff. One time I jumped from a burning dirigible with a woman in my arms. I was rescuing her. She didn't have a parachute. Well, it didn't particularly matter but I rescued her, even if she was a straw-stuffed dummy.

Then I became sales manager and coast representative of a parachute company and had to demonstrate my wares. That's one demonstration job where you don't have to take your customer along. In 1929 I toured the country on a "good-will" tour with Elinor Smith, the plucky little flyer. Recently I gave the folks down home in Rock Hill a scare, I guess, when I jumped from a ship while it was at the top of a loop.

Yes, I have had a lot of close shaves and my share of the thrills. All sorts of thrills and lots of them. But when that silk blossomed out over my head at the National Air Races, and I knew I was on my way down to a new world's record—that was the biggest kick I ever had—I'm certain of it.

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Fingers of Light

(*Continued from page* 100)

The mysterious and miracle-working photoelectric tube had not become a practical servant of man at the time of the World War. The story of the annihilation of the Nth company of infantry is, therefore, mercifully hypothetical; an illustration of what could be done today, or in any future war, with mathematical certainty.

A buried mine, connected with a properly located photoelectric tube or "cell," can be exploded by a distant beam of light as readily as a fuse may be ignited by a match. That is only one possible wartime use out of as many as an engineer's ingenuity cares to devise. But for every wartime use, there are a thousand peaceful applications.

Extraordinarily sensitive are these photoelectric cells—as sensitive as the familiar radio tubes to which they are related. Technically, they are electrical relays. They function by changing their electrical resistance with every change, however small, in the value of the light that strikes them. Batteries provide a local current through the cells, whose strength changes, of course, with every change in resistance. It is, then, the simplest of matters to make these changes in electric current operate whatever mechanism it is desired to operate.

Queer and spectacular results are accomplished by this means. In short, anything that an electric current can do may be controlled by a beam of light, or even by a difference in color or strength of reflected light, through the aid of the photoelectric cell.

But entirely aside from the seeming miracles of the photoelectric discovery, the searchlight itself, operated by a wind-driven generator on the plane, may wreak much havoc among enemy aircraft. A lone scout is flying through the night, his eyes finally accustomed to the dim vista below, illuminated only by an occasional star.

Suddenly there bursts, fairly in his face, a blinding, searing, insupportable glare of light. He twists and turns to escape that merciless, stabbing beam—but it is too late. The blindness of temporarily paralyzed retinas persists. His plane out of control, he goes spinning down to crash in the field below, and another victory is won without a shot fired.

The opposing plane's only weapon is a searchlight of many thousand candlepower, the most brilliant six-volt beam ever produced; the simple but deadly application of an old, well known principle.

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Lightplane

(*Continued from page* 109)

has a radius of more than ¼ inch, and care is taken in the bending, little trouble is liable to be encountered.

Aluminum cowlings should be made over a wooden form or a leather bag filled with sand or small lead shot. The size found in shotgun shells is about right. A round end wooden mallet should be used for a hammer. This prevents the metal from being cracked by the shearing effect of a small metal hammer.

The aluminum cowl should be heated to a red heat after every hammering by means of a blow torch. This treatment softens the metal, which becomes hard under repeated hammering. If a crack develops from the edge, a small hole about 3/16 inch in size should be drilled at the end of the crack. A small piece of aluminum is then bolted or riveted behind the crack. The aluminum tends to stop spreading apart, while the hole stops the crack from developing further.

Welding on metal or tubes should be done only by experienced welders, as this operation requires great care, and only an experienced man can turn out a job correct in all details.

The use of the small hand tools is a matter of common knowledge, so it has been thought unnecessary to mention the matter further. However, those who have motor driven tools, or those who are thinking of getting them, can find instructions on the proper use of them in the manuals put out by the manufacturers of the equipment.

You should think carefully before you purchase any motor driven equipment, and be sure that the kind you are going to buy will take care of any job that you may wish to do on it. Use a motor of ample power for running your circular saw, etc., and you will not be troubled by the machine stalling. It may cost a little more in the beginning, but the time saved by being able to do good work in less time will soon justify the extra initial expense.

* * *

In Part 2, to be printed in our next issue, Mr. Nagle will give instructions on proper shop methods to be followed in lightplane construction.

The Stratosphere

(*Continued from page* 112)

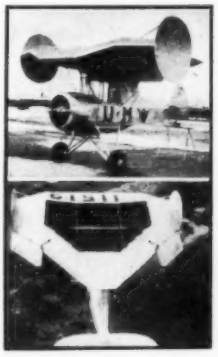
work of building the sphere of light metal to contain the aeronauts and their elaborate equipment.

No less than 27 years ago, Mr. Eustace Short, who is a keen balloonist and pilot, had thoroughly investigated the problems of an ascent to great heights in just this kind of hermetically sealed sphere. Recently, he and his brother have worked intensively on the project, which is being planned with a care that should ensure success on the scientific as well as the aeronautical side.

Every device modern science can suggest will be included in the equipment of the sphere, in addition to special breathing apparatus, and a wireless transmitter intended for the sending out of messages at brief intervals, all through the flight. For the first time a human voice may be heard by listeners on earth speaking from the appalling height of more than 80,000 feet.

Calculations show that the vast balloon should reach its maximum height in the incredibly brief space of one hour. After remaining there just long enough to make the proposed readings, the aeronauts will begin a slow descent. From start to finish the adventure should last six or seven hours.

The most likely place for the ascent is Cardington. So little is known about the air currents prevailing in the stratosphere that no man can estimate exactly where the balloon will land. It may touch the ground once more as far east as the steppes of Russia.



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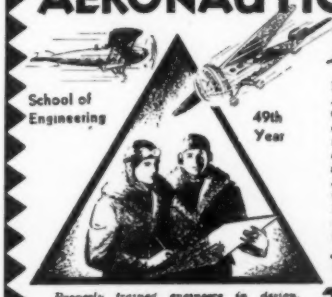

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Helium

(*Continued from page* 84)

THE helium used in airships, operated by the United States government, comes from government owned wells and plants. Gas for the Akron comes from the new plant at Amarillo, Texas. Government helium production makes the commercial extraction of helium not a very popular activity, because there are no other markets having a demand comparable with that of the navy and army.

But the outlook is becoming brighter. Commercial airship lines, planned for the future, must purchase their helium from private producers, because Uncle Sam is not permitted by Congress to sell helium.

Helium—so far a United States monopoly—is being shipped abroad in moderate quantities, mostly for use in research at universities and other scientific institutions. This research, incidentally, doubtless will result in many new uses for the gas. Every cylinder of helium that leaves this country does so only with permission of the President, the Secretary of War, or other high government officials.

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War on Smuggling

(*Continued from page* 98)

happier era. Fishermen of the Eastern Coast have made many big hauls as the result of directions broadcast after a patrol plane has reported a school of fish.

Not long ago, fishermen off the New England Coast were having miserable luck, so Lieutenant Melka took-off to see if he could locate more fertile spots than they were frequenting. And so it followed that a new field was discovered for aviation.

He was successful, and radioed information of a monster school back to the base, from which was broadcast the following: "The Master Mariners Association of Gloucester, has requested this station to broadcast to the fishing fleet, a report from the air patrol of Coast Guard Base 7, Gloucester, that a large school of mackerel is moving in the vicinity of four miles west of Stellwagon bank."

SINCE the time-element is of vital importance when a disabled plane comes down at sea, the Coast Guard stations along the Eastern Coast have devised a check-up system for planes. The plane's failure to appear at a predetermined point, automatically starts the rescue-machinery into operation.

All a pilot need do, to secure this check, is notify the first Coast Guard station along his route that he is making a trip at a certain time on a certain date, giving his starting point and destination.

From the moment of take-off, until he lands, he will not be out of sight of one of the 200 Coast Guard Stations for more than three minutes. Should he fail to appear over the station that is expecting him, a searching party is dispatched immediately.

And searching parties are quite popular among the pilots, one of whom took-off the other morning with the purpose of locating a boat that had been missing over-night. After finding the boat, and radioing its whereabouts to the base, he continued on his patrol and came upon a small fishing boat that appeared to be grounded. He landed alongside and called to the fisherman asking him if he wanted a tow, intending if it were wanted, to dispatch a boat when he returned to the base.

Much to his consternation the fisherman answered in the affirmative and climbed into the bow here he found a length of rope and solemnly proffered it to the helpful pilot!

AT PRESENT there are four planes in the Coast Guard service; two Voughts, a Loening OL5 and a Douglas twin-motored flying boat that is a recent acquisition. The General Aviation Manufacturing Company is building five more new flying boats for the service.

It is essential that the planes in this Service do more than simply fly. They must be equipped for landing in rough seas and remaining intact. When a father asks the Coast Guard to search the sea for his young son, over-due in a small sail boat, his request becomes "urgent business." He wants something done, and that immediately.

The pilots who have been making these search flights in old slow planes have suggested that fifty or sixty miles would be a long swim home, but when a search is requested, they seem to remember the unofficial motto of the Service—"Don't worry about getting back—all you've got to do is go."

Principles of Soaring

(*Continued from page* 119)

THE most important kind of thermal vertical current is the upwind found underneath cumulus clouds. Motor pilots, who were giving weird reports about the strange lifting power found underneath such clouds, used to be called "boosters." Today every soaring pilot who wants to be an expert in his game must know how to take advantage of this fast rising air column.

It feels like riding in an express elevator of a skyscraper, only that one gets more fresh air in the sailplane. However, the cloud is not creating the upcurrent, but instead the rising current is the father of the cloud. The warm rising air is cooled off at higher altitudes, and finally reaches the point where it condenses its moisture, which then becomes visible in the form of a cloud.

Every cumulus cloud must be the top of an upwind channel. Yet not every cloud is indicating a sufficiently fast moving upcurrent. The white domed cumulus with a horizontal base is usually the best one. Experience again is the best teacher in judging clouds in this regard.

EVERYBODY in aviation has heard about Robert Kronfeld's motorless flight over a distance of 102 miles. This marvelous performance was made possible by the force of the upcurrents in front of a thunderstorm. The rising thunderstorm, a menace to motor flying, became the dream of the soaring pilot for it enables him to reach altitudes up to ten thousand feet.

Like a huge wedge, the cold air front of a line squall or thunderstorm is rushing against the warmer air masses, pushing them upward. To stay in this storm front is the pilot's only and important task, for he knows inside the storm area that rain clouds forming a whirlpool would be awaiting him and his poor ship.

The perfect soaring pilot must be master of all the described possibilities. But let's not be ungrateful to the simple slope upwind, for we still need it to reach the zones of thermal and front upwinds if we don't have our sailplane towed up behind a motorplane. The accompanying table gives the approximate vertical component velocities of the different rising air currents.

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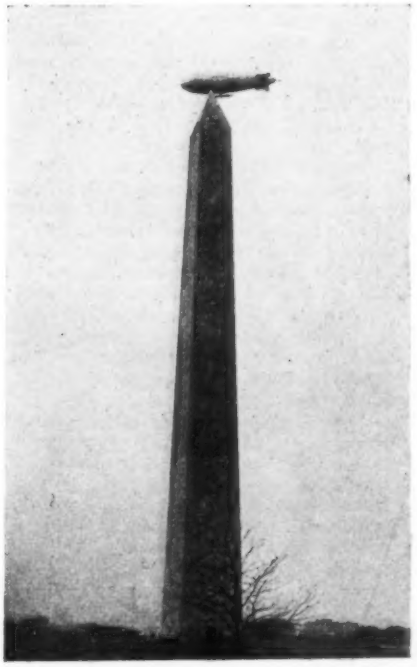

This blimp is not taking a rest on the top of Washington Monument. No. It was just passing by when the camera caught it in this position

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PAY US LATER

Laurence Hargraves

(*Continued from page 78*)

it, always keeping it at such an angle that the air current pressing against it pushed it upwards. From that he went on to the idea of having twin kites side by side, with a bar joining them and with the string tied to the middle of the bar.

The wind playing against one kite would bounce off against the other and help to uplift it. The two kites, if balanced, would counteract any tendency toward ducking.

The idea was an inspiration and he developed it until his final models were the pattern for all box kites made afterwards. In order to utilize all of the wind pressure, he made his first box kites something after the pattern of egg boxes, that is to say, cardboard boxes with small cells in them.

Hargraves made the kites with six cells in each box and then joined these big cardboard boxes by a bar. Before long he found he could do without the cells, and therefore used the plain box structure. Finally, it was found that the two boxes could be brought so close together that they touched, and the bar joining them could be eliminated, without disturbing the balance of the kite.

When Hargraves arrived at that point, he believed that an airplane could be built after the manner of a box kite. The first European biplanes were truly variations of the box kite design. In 1893, he displayed his kites for the first time and went with them to America where they awakened a good deal of attention.

Perhaps those were the happiest times of Hargraves' life, for he found himself recognized and applauded. His kites were of epoch-making importance. They had far greater lift than any apparatus previously discovered and on one occasion lifted a weight of three hundred pounds.

Hargraves' experiments soon convinced those interested, that the airplane was possible, and several men began to put his idea into practice. Farman, Voison and Santos-Dumont produced their first airplanes which were really box kites fitted with an engine to give the necessary movement through the air.

We may say that by 1906 the problem of flight principle was solved, and all that remained was to perfect the means. However, they still lacked an engine, light and yet powerful enough to lift and maintain the machine in the air.

Hargraves then set to work and invented a rotary engine. He had a three-cylinder screw engine so made that the base of the propeller was an engine, and so that the cylinders could revolve around the crankshaft. The pin through the shaft would be stationary, and the thrust came on the valve face. It will be seen that this was the germ of the famous Gnome rotary motor introduced in 1909.

Ship Packs a 'Chute

(*Continued from page 99*)

'chute, which in turn yanked the imitation cabin out of the target glider.

In experimenting with the big 80-foot parachute, as much as 3,000 pounds of lead were taken aloft in a bombing plane to determine how this load would be handled when dropped from the plane. The big triangle 'chute appeared to handle the load easily, billowed out and floated gently to the ground. Motion pictures taken of the experiments showed that this big load reached terra firma in a slow, easy glide.

The 80-foot diameter triangle parachute is designed to carry a normal load of 2,500 pounds, or the equivalent of a 12-passenger cabin of a transport plane. It is made of silk material and is designed to be housed in the top of the cabin. A pull of a lever by the pilot is all that is required to effect its release.

The pilot 'chute, tucked away in the tail group of the airplane, is the first to obey the summons of the pulled lever. In the space of three seconds, the big 'chute is open and, with a load of 2,500 pounds, its rate of descent to the ground is approximately 18 feet per second. Being the triangle type and lending itself readily to steering, dangerous or undesirable landing places can be avoided by manipulating the shroud lines.

Those engaged in this experimental work have high hopes for this new type of parachute, asserting that it should be a simple engineering problem to so construct the cabin of a modern passenger plane so that the mere pulling of a lever by the pilot would free it entirely from the rest of the plane.

Interviewed by a representative of the Associated Press regarding the cabin parachute, Major Hoffman stated, in effect, as follows:

"The development, if it fulfills promise, will not be limited to use when something happens to an airplane in the air. Our glider experiments have shown that even when the cabin is detached the airplane will fly. Thus, with the cabin 'chute, a pilot may be sent with supplies, medicine, soldiers, or food to flood-ridden regions.

"The cabin 'chute, we have calculated, will not weigh more than 30 pounds per passenger seat — perhaps less. The individual parachute weighs 20 pounds per passenger. When a transport plane crashes, usually everyone aboard is killed and there is no way of determining what happened. By the cabin 'chute, we hope that not only lives will be saved but also that those aboard will be able to report exactly what happened.

"The cabin 'chute, we believe, will have many advantages over the plane-parachute which has been given some tests. In the latter, the parachute must be exceedingly large, and there is no way for the passengers to get away if fire breaks out. For passenger planes we have figured that it will cost 15 cents per day per passenger seat to equip them with the device."

Now Col. Roscoe Turner, a practical aviator, rather differs in opinion from the findings of the Air Corps. It is his belief that a large parachute should be attached directly to the ship and a photograph accompanying this article shows this 90 foot 'chute under test.

Colonel Turner expects to lower his fast racing cabin plane with the parachute directly connected to the ship. His experiments will be watched with interest by all operators of airlines carrying passengers.

It is a question whether such a large parachute would be of much value unless it were made of non-inflammable material for reasons already stated. However, we never know in aviation how successful a device will prove until after the device is thoroughly tried out in practice.

Aloft in a Blimp

(*Continued from page 89*)

h.p. souped up Laird, Teddy Pyle in something and Russ Thaw in his special Lockheed Sirius. Below them is Captain Harry Rogers in his RBX—a handsome ship in deep maroon with yellow wings.

Now just a moment, folks, while I turn the mike.

"Puppa puppa, pow! Puppa puppa, squeak! Puppa puppa, moma!"

The sound you just heard, folks, was Bernie Capeheart flying by in his 3½ lung flivver.

Getting back to the game again, it looks like a deadlock up here. Old Man Wind has held his tackle for the past six hours and Hobie has his gun full on which is keeping the blimp stationary over the field.

The boys are resting comfortably in the control cabin and Trotter has broken out a pack of cards. They're playing poker now, folks, and the sky's the limit! Heh! Heh!

The game has been on for nearly twenty hours now, and if Hobie didn't have the motors full on and make futile though frequent detours over the Bronx and Brooklyn cemeteries, Old Man Wind would have thrown the blimp for a three thousand mile loss by this time and you'd be hearing this broadcast from Europe We can't do that, folks, not at the price you're paying!

Hobie's getting awfully low on gas, now folks. Yessirree! Awfully, awfully low. He's going to lose altitude and see if Old Man Wind is any weaker down below. That's using his head!

At an altitude of two hundred feet, there's only a velocity of 16 m.p.h. It looks as if Hobie is going to make it, folks, he's going to bring the blimp up in the lee of the hangar. Looking over the side he can see a ground crew of thirty and a Scandinavian dog-catcher. The dog-catcher is on the premises through the courtesy of the

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Indigestible Puppy Food Company, folks—there should be a can in every home.

Hobie's circling right over the ground now, folks, and it's his blimp. No, it isn't, it's Old Man Wind's. No, I'm wrong, it's Hobie's! Yep, it's Hobie's. A beautiful forward pass of a mooring rope from the twenty-five yard line with the entire ground crew, including the Scandinavian, grabbing for it.

Old Man Wind is beaten, folks—after 20 hours of play! They're walking the Blimp into the hangar now, folks—it's been a great game. Wait until I see if Hobie won't say a few words into the Mike. Here ya are, Hobie, lie to the folks!

"This is Roland Hobensack, pilot of the Columbia, talking, folks. It's been a great game and I'm glad I'm down! You would, too, if you caught Trotter and Dixon each holding three aces!"

Thank you, Mr. Hobensack. This is Graham MacNamee Schnurmacher, bidding you goodbye over the POPULAR AVIATION network. When you hear the musical note it will be time to go in and chase the horseflies out of your hangar!

Flying in France

(*Continued from page* 80)

collisions on the high seas, even if you are to fly only over inland waters.

Now, you got your license. You take delivery of your plane and fly away to your estate in the mild climate valley of the Loire. You clip off the 200 miles in a little better than two hours, and make a perfect three-point landing on the turf of your own meadow, helping your wife out of the rear cockpit.

Before you have time to get into the house a "gendarme" is in front of you, writing up a "ticket" for violation of air traffic rules. In France you cannot fly from your own estate nor have your private airport, even if the nearest "national" airport is 50 miles away.

Undaunted, you change over to a twin float undercarriage, and hope not to be bothered any more. Alas, you will not land three times before the stiff moustached man in blue orders you out of your cockpit, asks you a thousand most indiscreet questions and "writes you up" again for illegal landing. Few, and far apart, are the places in France where you can land a seaplane without a written permit of the Air Ministry.

Forced back into the channels of regular national airways, you suddenly hear your motor misfire, but somehow manage to land on a regular airport. The mechanics find your gas filter clogged and change it. You take-off and go home, but on the next day you are notified of the grounding of your plane by the local inspector—"because the lock nut of the gas valve on your gas filter is not of an approved type."

We have heard of many complaints against the Engineering Division of the Aeronautics Branch, U. S. Department of Commerce, but I advise the complainants to go to France and learn about the S. T. I. There he will find the tyrannical, inconsistent and often haphazard rules to be the curse of the industry and a permanent topic for its papers.

Sobered up and delusioned, you'll put thumbs down and hang around the "training centers" where the reserve pilots come every so often for practice flights. Then you'll make friends with them, casually join two of them in a formation flight, and soon will find yourself under voluntary military training at your own expense.

Later, somebody may hint that you will get a faster plane by entering one of the many "Tours" and competitions of the European "calendar" and you may finish in the money.

Months and years will roll by, you'll become a French citizen and your sons will near their 20th birthday. You'll be an old-timer after this and most likely will be in the employ of the industry. Then, and then only, will you be privileged to fly about unrestrictedly.

The government will send you abroad on costly and arduous "propaganda" flights and eventually will be picked to rush some "big shot" to a distant possession.

Some of our readers may think this sad story exaggerated, but five months of close investigation of French aviation compels me to say that I haven't overdone a single detail, and that a close scrutiny of the French aviation papers will disclose even more troublesome facts.

Under the present system "private flying" in France is for:

1. The training of air reserves, and young military pilots.
2. Testing and development of new equipment.
3. Propaganda flights for the sake of the nation's prestige.
4. Providing the ground organization for servicing foreign planes passing through the country.

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LEONARD HICKS
Managing Director

The 500 M.P.H. Limit

(*Continued from page* 106)

small size model tests, but now we have something more definite for the practical utilitarian readers. I now refer to the events taking place last Fall at Caldershot, England, where they tore the atmosphere wide open with real ships instead of dummies, and further, through a wide range of speeds terminating with a high speed of about 80 per cent of our 500 m.p.h. limit.

This Schneider Trophy race interests me in only one respect. That is, it is a definite series of events extending over a considerable period of time, made with a fixed object in view and all events under the same general conditions. This, as you see, makes the speeds and power of the various craft more closely comparable than possible with data selected helter-skelter from a dozen different sources. This series of races started out in 1913, and continued up to the Fall of 1931—the last race of this series.

As might be expected, the first four races were largely experimental in nature with all sorts of competing craft and engines. One year, the winner would be a flying-boat and the next year it might be a seaplane, followed the next year by something else again. As a result, the first four races of the Schneider series were rather erratic in respect to power and speed, as might be expected, but after things got simmered down and lined-up with a fairly standardized type, then we started to get a look-in on some really interesting data.

Then luck was with us again in the sense that in 1922, 1927, 1929 and 1931, the races were won by the same make of ship—Supermarine—which makes matters comparable with fair accuracy.

We can show whole columns of figures, but I believe that the accompanying horsepower-speed graph shows things far more clearly. Here, I have plotted the speed and corresponding horsepower of each year's race, and have connected them together with a heavy black line that shows the trend of the horsepower and speed ratios.

Along the lower edge of the chart will be found the scale of speeds in miles per hour, ranging from zero at the left to 450 m.p.h. at the right. The vertical scale at the left is the scale of horsepower, ranging from zero to 3,000 horsepower. Thus, it is a simple matter to locate the horsepower corresponding to a given speed at a given year. Running along the heavy broken line, representing the actual events, we have a dotted curved line that has been plotted from mathematical calculations based upon the so-called "theoretical" considerations.

Now, as before explained, there is a whole lot of confusion in the solid line graph for the years 1913, 1914, 1920, 1921 and 1922, because of the differences in the types of ship and uncertainties in construction. However, in spite of the zig-zagging at this point, you will note that the dotted calculated line runs right through the center of these zig-zags so that it represents a fair average. This would more closely coincide had the ships all been standardized and of one general type.

During the year 1922, when the Supermarine seaplanes first started rolling off their victories, the variation starts to be more uniform and consistent, and the heavy line graph proceeds progressively and successively upwards in rough agreement with the computed law. The dotted curve passes through, or very near, to all the points with the exception of the year 1929.

Now this is the thing that I wish to point out—most of all. It is the fact that the power starts to build up very rapidly for a given increase in speed after the year 1927 when the speed was 281.65 m.p.h. It jumps from 875 h.p. to 2,600 h.p. with a comparatively small increase in the speed, and this is what I have been lecturing about all the time. The dotted computed line indicates 3,000 h.p. at 427 m.p.h. and this speed is a long way from 500 m.p.h. with the graph sloping as abruptly as it is doing at this point.

Now the computed dotted line more nearly approaches the vertical as it goes up, so that it would probably intersect the 500 m.p.h. line at about the 7,500 h.p. mark. The installation of a 7,500 h.p. engine of the present type would certainly introduce some difficulties, and heaven alone knows that the disposal of 2,600 h.p. was a hard enough problem. Just think of a 7,500 h.p. engine consuming fuel at the rate of 0.5 pound of gasoline per horsepower hour! This would amount to 3,750 pounds of gas per hour or about 750 gallons in the same time!

Do you think the game is worth the candle? I'll frankly say that I don't. And how would we carry all of this gas even supposing for the minute that we could dispose of the heat?

Now, there is a still better method of comparison that gives more illuminative results than the simple plotting of the horsepower against the speed. This is the use of the number that represents the relation of the horsepower to the speed directly. To visualize this ratio, I will say that it indicates the average horsepower required to propel the ship one mile per hour.

Thus, if we have a trainer flying 100 m.p.h., when equipped with a 90 h.p. engine, then the speed ratio becomes—$90/100 = 0.9$ which is just the same thing as saying that 0.9 h.p. is required to drive the ship each mile per hour.

Now look what we get into when we get up to the range of speeds comprising the Schneider contests. See how they consistently increase the ratio when the speed is increased. In the following table we show only the Supermarine contenders so as to get a more accurate comparison than when the various makes are listed.

After 300 m.p.h. is passed, note that the ratio remains consistently above 5.00. In 1922, only 3.09 h.p. was required to produce one mile per hour speed. At the highest speed attained in 1931, this increased to more than double the value of the ratio, or 6.36 h.p. per mile per hour. In spite of all of the improvements made in streamlining the 1931 racers, and all of the other modifications made, Old Man Speed Ratio could not be kept down within reasonable limits.

To get more speed, we naturally increase the horsepower output of the engine. A larger engine weighs more, and the greater amount of fuel consumed weighs still more. In addition to these weights, the structure of the ship must be correspondingly heavier to resist the heavier stresses, so all in all, still more power must be developed to support the increased weight.

There obviously comes a time when we can no longer indefinitely increase the power to the point where it will take care of the added weight, and this is just one of the definite stopping points for projected increases in speed.

The problem of the automobile is somewhat different—considerably different. The auto is supported by the road and therefore no power is taken for supporting the machine. All of the power developed in a car can be employed exclusively for splitting the wind and developing speed. And this is just where the airplane is different because a greater and greater percentage of the power is taken for the support of the increasing weight when the speed is increased.

If certain mechanical factors could be taken care of, and possibly they might be worked out, then the dirigible would stand a better chance of becoming speed king than the airplane for the simple reason that all of the power developed by the dirigible's power plant could be devoted to driving the ship forward. None would be expended for supporting its weight for the helium gas would take care of that factor without an expenditure of power.

We may rather laugh at the idea of the present clumsy sluggish dirigible ruling the world of speed, but it has more than a slim chance of doing just this thing because all of its power is available for driving the dirigible forward and that is more than can be said of the airplane power-plant.

Now let's take a look at the propeller which would certainly have to do some propelling at 500 m.p.h. The problems are difficult enough at 400 m.p.h., but what would they be at a 25 per cent higher speed? This means a propeller tip speed of about 1,000 feet per second, or thereabouts, and every engineer knows that the losses are terrific near this speed.

Sailing up in the stratosphere, 10 miles above the earth, might offer a solution but the writer does not just see how this would work out—at least not at present. The resistance of the air would, of course, be reduced but at the same time it is likely that corresponding troubles would arise elsewhere—notably a lack of oxygen for the engines. Mebbe so and mebbe not.

XUM

Early Birdling

(*Continued from page* 120)

mile or so of straight flight, for a turn close to the ground could not be made under these conditions, had netted an altitude of fifty or sixty feet above the ground. Now for a slow turn and back to the starting point.

The attempted turn proved unwise, for in addition to the loss of the benefit being derived from a light head wind, the increased air resistance resulting from the use of the rudder, caused the machine to settle in such an alarming manner that the turn had to be abandoned promptly to avoid a landing while turning. Out of the fat into the fire—I was now in a most serious spot, for right in my path was a very large compound surrounded by a high adobe wall.

Too late to try a landing outside the compound—I was losing altitude so fast that there was not a chance to reach the opposite side. Just one chance to escape—drop the nose of the machine in hope to gain a little speed—then stake everything on a zoom at the last moment.

As I passed over that compound, the thud of hoofs and clash of horns was clearly audible above the familiar sound of the engine. I held the dive as long as I dared, then pulled back on the control. No response! Plowing right for the inside of the adobe wall—then sluggishly the nose lifted and the front wheel cleared. The rear wheels adjusted the top of the wall as the machine, every ounce of its energy spent, lost speed and stalled to the ground just outside the compound.

The following day, the show was on. The city turned out to see the flying and conditions seemed better for flying than on the previous day. A little breeze aided in getting-off, and upon returning to the grandstand, I had gained the majestic height of perhaps seventy-five feet above the ground. Good. Another circle would add to my height, then maybe it would be safe to try some stunts for the spectators.

The field adjacent to the flying field was crossed by ditches with dykes on either side arranged in such a manner as to leave small landing places. It was necessary to land immediately after passing one dyke in order to avoid hitting the next one.

It has been stated that people who live at low altitudes do not judge distances accurately when first introduced to high altitudes. I believe it, for under normal conditions I could run my front wheel on a chalk line, or roll a ball along the ground with the wheel without touching the wheel to the ground.

Be that as it may, in place of clearing the first dyke, the front wheel hit it so hard that I was jolted clear out of the seat—brushing the throttle wide open as I went.

With one foot caught in a landing gear brace, my shoulders dragging and bouncing along over the uneven ground, the machine raced headlong for the next dyke.

To kick myself loose was to go back into the propeller which was turning at full speed. Every time my shoulders bumped on the ground, I tried to bounce high enough to reach the magneto switch, but no use. With a crash and a cloud of dust, the machine introduced itself to the dyke. With the machine at rest I managed to reach the switch, disentangle myself and crawl away from the wreck for a little distance for safety in case of fire. Even to crawl was painful. Breathing was difficult as blood was choking me.

As I rested on the ground, propped up on one elbow and gasping for breath, a horseman rode up to look at me. Did he dismount to help? Not much. He turned sideways into a comfortable position in his saddle, proceeded to roll a cigarette and grin at the sorry plight of myself and the machine. Just an example of the sympathy frequently extended by spectators to an exhibition flyer.

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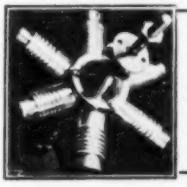

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T-S-F Silenced

(*Continued from page* 78)

gle-seaters, not known to Billy, completed this unit.

There was only one thing in mind now—success. There could be no failure. The German T. S. F. must be wiped out.

* * *

THEY were over a stretch of thick woods about twenty miles from the lines, and at an altitude of about five hundred feet, when Billy's eye caught the bright gleam of a metal strip apparently strung between two trees. And there was a mound of something dark. Much too regular in form to be a work of nature. Was he on the right trail? It looked like it!

Yes! There were three moving specks down there, moving toward the mound. Then, another copperish metal gleam. Convinced that he had at last located the long sought objective, he signalled to his gunner, Prescott, and then to Middleton and Fairbanks, about half a mile behind him.

Around he came on a steep bank, and swooping down at a sharp angle, raced over the suspected mound at about one hundred feet. Now he was low enough so that his eye could penetrate through the camouflage, and directly beneath him was a sheet iron shack with two crude antenna masts at either end. Another gleam from below from a number of parallel copper wires above the shack. There it was, and if it were not the precise station that they were seeking, it was at least one more German radio station that would be put out of the way.

Now around in another banked turn, and still a little lower so as to take in the situation more closely. At fifty feet, the whole affair stood out from the camouflage in bold relief—and then "Zang!" as his landing gear tore into the cage antenna, which he had approached too closely in his eagerness to survey the building. Men were running about in every direction now, out in the open and heading toward the shack for its protection.

Now up slightly, around on another bank and then a highball to Prescott to "let them have it" on the next trip across the shack. And Prescott, all alert for the critical split second, let them have it with a vengeance. By this time the four single-seaters were in the game, and were ripping up the shack in turn. The sheet metal roof danced and gradually fell to pieces under the fire. The sod and dirt banked about the building spattered and melted down under the fusilade.

At the first few bursts, one or two figures ran out of the door and fell—but now nothing moved around the riddled shack. Not much chance of escape from that attack. Billy wondered whether any more code was jumping off the shattered antenna. Better go home now and get in touch with matters at headquarters, or else signal the bombers to clean up what was left.

Billy and his escorts were soon winging it home, probably five miles on their way. Then came a slap on his back from Prescott, a signal that enemy planes were in sight. A quick look behind informed him that Prescott was correct—more than correct, if that might be—for a half mile behind him was a squadron of eighteen Fokkers.

On they came, cavorting and swinging in the sun's rays. A ghost of a chance now, for Billy had very little altitude. He had been too careless and too self-satisfied to take advantage of the safety that altitude gives to a fighting ship over enemy country.

The Fokkers decided to attack the Americans' lower flight—Middleton and Fairbanks. As they nosed down, Billy and his companions dived headlong. But they were outnumbered six to one without counting the enemy planes in the sun. Already a Fokker was pouring a stream of bullets into one of the lower flight planes as Fairbanks made a desperate vertical dive and shot the Fokker down at fifty feet. Then the enemy from the sun arrived, and the scene became an upheaval of darting, twisting planes and tracer bullets streaking in all directions.

Zooming upward, to get out of the line of fire, Billy passed a busy Fokker and, by sheer skill in handling, lined it up for Prescott, who sent it down in flames. But the overwhelming odds were momentarily too much for him. He savagely attacked the leader, but before he could do any damage, the other enemy planes forced him off and prepared to shoot him down in turn. For a moment, the outlook was desperate.

But again Billy's amazing quickness of thought and action came to his rescue. By a series of astonishing maneuvers he completely outwitted his foes for long enough to return his attentions to their leader. A burst of forty shots from the American plane, and the enemy leader went down in a nose-dive. But Billy did not get away scot free, for he had to make for home with a punctured pressure tank. Even greatly outnumbered, there were no casualties.

* * *

NOR was the young American flyer always lucky in getting into the action he craved. On one of the greatest and most spectacular raids undertaken by the 18th Squadron, two weeks after the radio adventure, he had no sooner reached the objective area than he was forced to return to the base with broken connecting rods. The story his comrades brought in that day left him with badly mixed emotions; for while he was overjoyed by their remarkable accomplishments, yet he envied them their hours of fervid excitement and he felt bitter over his own enforced idleness.

The plans for the next day contemplated an attack, by two squadrons of the Royal Air Force protected by the American squadron, on an enemy airdrome at Varssenaere, which was known to contain five squadrons of Gothas and Fokkers. Carrying twenty-pound bombs, the squadrons were to attack in one, two, three order—the Americans last.

By the time the English flyers had dropped their bombs on hangars, buildings and gun emplacements, daylight had come and the enemy had some defensive activities organized. But disregarding all caution, the ten American planes swooped down noisily and precipitately, bombing the remaining buildings, firing machine-gun bursts into hangars, planes and officers' quarters and dashing and twisting so crazily about the field that the confused enemy personnel did little but run for cover.

Jerry Middleton, a dashing but careful flier of much experience, made a spectacular flight straight at the side of the chateau where the officers were billeted, firing into the windows. Then he zoomed up over the edge of the roof, executed an Immelman turn, dropped to fifty feet and set two machines afire. Bob Michaels, following, almost duplicated his achievement and made note that even enemy planes on the ground were afire, while the northeast hangars were blazing.

Meanwhile, all the other flyers of the 18th Squadron were leaving their marks on the devastated airdrome. Not one of them withdrew after dropping his bombs—which, in nearly all cases, found their targets with calamitous precision. Machines on the ground were almost all destroyed, and defense was paralyzed by picking off the gunners as they ran to man their nests.

Jake Dillson had to be content with a bomb and gun attack on the chateau, after which his air pressure went dead and he had to climb. And Ernie Atwater, to his vast rage and chagrin, lost the patrol altogether; but, not to be counted out, he circled over Ostend and dropped his four bombs on it from 6,000 feet. Nearly all of the American planes returned safely in the triumph of audacity.

When the amount of damage actually done by this extraordinary raid became known some months later, the figures proved to be astounding. No less than fourteen enemy machines were burned or destroyed; one hundred and forty mechanics and twenty-six pilots were killed, and it took ten days merely to clear the field of building wreckage.

The very next day after this great

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raid the squadron, escorting a flight of English bombers, was attacked by a large formation of Fokkers. Arthur Fenton and Emmett Rice shared the honors in this battle, each managing to shoot down one Fokker in the most desperate maneuvering, surrounded by enemy planes, and then escaping by sheer clever flying, using spins, spirals and all the other tricks of the air.

We have already seen Billy Skelton through the hardships of a punctured pressure tank and broken connecting rods. His next mechanical adventure of this kind came near being his last. Billy, his friend Ernie Atwater and George Arend, were bombing a road full of enemy lorries and doing very well at it, but the defense was severe.

Suddenly Billy felt a violent impact on his back and knew that he was hit. It was his first wound of the war, and he had no idea how serious it might be. Before he could think much about it, another bullet punctured his gas tank, and the plane's life fluid spurted out with shocking copiousness. Forgetting his own injury, he hastily inserted his finger in the hole for a plug and, maneuvering desperately with the other hand, managed to evade three Fokkers. He got into the British records for that feat, but it put him in the hospital for a few weeks. One of his best friends, Allison James, a promising youngster, failed to return from the flight. He was shot down without injury, but taken prisoner.

Air Mail Covers

(*Continued from page* 93)

The collecting of air mail covers really began back in 1870 at the time of the Prussian Siege of Paris. At this time, Paris was entirely cut off from direct communication with the outside world, and for a period of over one year, mail was carried to and from the unfortunate city on free balloons manned by daring pilots.

After the invention of the airplane, Earle Ovington and other far seeing pilots carried a few letters on short experimental flights. The first official air mail to be carried in the United States was between Nassau Boulevard and Mineola, Long Island, New York, September 23rd to October 1st, 1911. This air route, the first in history, was established by order of Postmaster General, Frank H. Hitchcock, who appointed Earle Ovington as the first "Aeroplane Mail Carrier."

The government and Post Office Department considered the establishment of a regular air mail route and on May 15th, 1918, the first regular air mail line in the United States was established. The flight was from New York to Washington with a mid-way stop at Philadelphia. The postage rate was 24c for each one ounce letter. A special air stamp was provided. This was the first United States airmail stamp.

For the purpose of marking this important flight a special cancellation was used, reading in a circle: AIR MAIL SERVICE—WASH. PHILA. N. Y. In the center of the circle was MAY 15th, 1918 FIRST FLIGHT. At the bottom of the circle was given the name of the city in which the mail originated.

After the establishment of this Pioneer Route, very little interest was shown until 1926. Since that time, the hobby has grown until no phase of philately (postage stamp collection) has had such rapid growth in so short a period of time. At present, Aerophilately numbers over fifty thousand collectors among its devotees.

If you are a collector of air mail covers you are a recorder of history—the history of the development of aviation. Every little air mail cover carries with it a tale of another step in the development of flying. By collecting these epochal covers you are making yourself a part of this history which is as enduring as the discovery of the new world.

Collecting air mail covers is not a hobby restricted to one field as there are a dozen or more branches. First flights, airport dedications, air-meets, air races, Canadian flights, foreign flights and several others offer every collector the opportunity to specialize in one field or to collect as many varieties as he pleases.

The early mail covers, those of 1911 to 1918, are known as Pioneer Covers. These originated in the United States before 1918 as a result of special permission granted to barnstorming pilots, to fairs, races and other early events.

The Pioneer Air Mails have no cachet but can be easily recognized by a special cancellation. The Experimentals are those carried by United States Army Pilots from 1918 to 1926, as an experiment to prove the possibilities of regular air mail routes. These bear no cachet but a special postmark.

First Flights, contract air mail (C. A. M. & A. M.) covers are at the present the most popular phase of the hobby. While there is a great net-work of established air mail routes the surface has barely been stretched and there are many more to come.

These letters all bear the official Post Office cachet, and in many instances, also an unofficial cachet applied by a civic club to first flights. The mail carried from airport dedications is also popular as each new airport plays an important part in the development of aeronautics. These covers have the unofficial cachet applied in many unique designs.

Historical covers are those carried on flights of some historical importance, such as ocean flights, world flights and other notable attempts. Covers of this nature are very scarce and command a high purchasing price because only a small quantity of mail is carried—usually for a few friends of the crew. Occasionally a bag of collectors mail is carried. These seldom have a cachet but can be identified by postmarks, written inscriptions and autographs of the pilot or crew. The autographed cover is very scarce and hard to obtain.

As an aid to the collector, there are many magazines and periodicals devoted exclusively to the hobby. These list future events, describe various covers and give much valuable information in general. The postal officials do not hesitate to lend as much assistance as possible and occasionally they consult the collectors on the various air mail services and other problems concerning it.

In addition, there are dealers in all parts of the country ready to purchase your duplicate covers and sell those you do not have. Auction sales are conducted several times a year by responsible parties and many rare covers can be had at very attractive prices.

To top it all, there are three or four international Air Mail Societies devoted to the furtherance of Air Mail cover collecting. Membership in any one of these societies will enable the collector to form contacts with other members scattered over the world.

No one can realize the pleasure and thrill of collecting air mail covers until he has received a few of his own. New air routes and many other interesting aeronautical events are taking place daily and the wide variety of covers assures aerophilately a great future—even greater than the past, which has grown to its present state in leaps and bounds. If you are the least bit interested in collecting air mail covers you cannot keep out.

Our Readers

(*Continued from page* 102)

promptly let loose, but the other held on. He was also lifted in the air, but he pulled down my wing to about 40 degrees, when he dropped off. I slid out over the surf and away from the car, and all I could do was to hold full opposite control. I landed in the edge of the surf, but got leveled off enough so that only an end rib was broken.

The other little accident happened when I jumped off a low bank, but I didn't get enough speed. The glider turned up on her nose—and I dove on mine. This was another accident caused by too much hurry, as I knew that the wind was too light, but I had waited so long that I tried it anyway. There was no breakage, however.

I was assisted in the project by my brother and Don, Tom and Virginia Ross and Clarence Burlingame, besides some others.

Well, fellows, this shows a whole lot of interest in this department, and if you can only keep it up, then we will all profit by the information. It is an excellent way of getting into touch with one another all over the country.

We think that a very interesting contribution for the next issue would be some photos and descriptions of these Ford and Chevrolet engine conversions that we hear so much about. Still better will be some shots of the ships in flight. So long.

Airy Chat

(*Continued from page* 74)

tion, will be interested in an article on "How to Build Your Lightplane Correctly." In this article the author takes up the matter of shopwork and materials, subjects that have been omitted in the majority of construction articles to date. There are many useful kinks described that will prove helpful to the builder who is not any too certain with his tools or in his judgment of materials.

* * *

AND next we take up a letter by Fred B. Cannon, Jr., 514 Market St., Fairmont, W. Va. He takes exception to the statements contained in a letter by Ralph Pritchard, printed in a previous Airy Chat, and sets forth his views as follows:

What is the matter with America?

I have read three articles that slightly disagree with Ralph Pritchard's article. The first has to do with our commercial aviation resources. A well known manager of a large midwestern airport said, contrary to public opinion, that our country is at least 15 years ahead of commercial aviation in Europe.

This, he says, applies to both service and equipment, while night-flying is still confined to North America. He says that military aviation is the branch that gets the most publicity, but that the United States definiely esablished a fine record for service in commercial aviation.

The second article is by Capt. Thomas B. Doe. He says that all countries are building up their military air services at top strength, with the possible exception of our country. Capt. Doe says that a large reserve could be dispatched to the front in less than 72 hours if necessary.

This reserve is to come from the huge commercial air resources in our country. The large passenger ships could be converted into bombers, soldier and supply transports. Air mail and private craft could be converted into reconnaisance ships, days bombers or fighters, and the remainder of the civil craft could be used for training, supply and ambulance ships.

The third article deals with our civilian pilots and is in a report by the Aeronautics Branch, U. S. Department of Commerce. The United States has 16,709 civilian pilots, Great Britain coming next with 3,427 civilian pilots, which is quite a drop. Although these men are not trained as combat fighters, flying is not new to them, and army officers regard them as a very important reserve.

They say that these pilots could be, under war conditions, allocated to 175 training centers throughout the country, and could be quickly put through a rigid course in combat flying. Aside from this, there are numerous government reserve flyers and active flyers.

Who cares about speed records or Schneider Trophies, anyway? Too many of our good flyers, like Lowell Bayles, Freddy Lund and Capt. Page, are killed in races or trying to break a speed record.

I do not think that America is outclassed by any country in aviation.

This is an interesting debate, any way you choose to look at it. We are not taking sides at all, but starting with this issue, we are having some of our best writers comment on the subject, pro and con, and trust that such articles will set us right on this subject.

* * *

WELL, well, at last the lightplane flyers of Ohio are revolting against restrictive air laws. Ivron Erwin has written in and asked us to acquaint all Ohio readers with the fact that an organization is being formed by home airplane builders. This also includes unlicensed airplane owners. They are trying to test this law or have it amended. All those interested should address Ivron Erwin, 919 Fourth St., Gallipolis, Ohio. Isn't that the town which claims O. O. McIntyre, columnist?

* * *

HERE is something for American airplane builders to think over. A. A. Askew, Jr., has written to a number of American airplane manufacturers for plans of their ships, but so far, he says, has received no answers to his letters. On the other hand, he wrote seven letters to British airplane manufacturers with a request for plans and had a favorable response from all of them. It rather seems to us that the mailing of such information would be a good publicity feature, and we fail to see why the majority of American manufacturers are so stingy with their drawings.

* * *

THERE has been a whole lot of discussion among our readers on a very interesting topic. This discussion is rather in the form of a debate: Resolved, the autogiro is superior to the airplane. Just at present, the contestants are about equally balanced—50-50—so in order to break this magic spell we will ask for further contributions on this subject. Write us what you think—or don't think—concerning the merits of the autogiro.

* * *

AND then about that Photo Club that we suggested in our last issue. We have about five photo fans all listed and addressed and now comes another variety of the same genus who is collecting scale and dimension drawings. Maybe we'll have to put him in a special chapter of this organization. If you are interested in scale plan, we advise you to address Harold Shupp, Blackwater, Missouri. Then we have A. A. Askew, Jr., Box 72, Barrytown, N. Y. This fan is evidently very much interested in British planes.

Among the photo collectors are G. B. Jarrett, 18 So. New Jersey Ave., Atlantic City, N. J., and then there is another photo fan, Frank Beilfuss, 7127 Luella Ave., Chicago, Ill.

WE promised to start the publication of scale plans of the full size ships for the benefit of our model builders and others, and so we live up to our word by showing three views of the Laird "Super-Solution" in this issue. All in all, I'll bet that we have had at least fifty requests for scale drawings of this sort, and if the interest continues, we will promise to include plans of all ships having popular interest.

* * *

OUR cover for this issue is, we believe, a most striking design. It is not only artistic, but it also calls to your attention the importance of he searchlight as an airplane accessory. Now, while searchlights are nothing new, considered as searchlights, yet very recent improvements in these projectors have made them highly effective and worth while installing. The makers of the new searchlight claim that the beam is so intense that a newspaper can be read easily at a distance of five miles from the lamp.

* * *

WE are paging J. C. Canfield, builder of the wind-wagon shown in a previous issue of POPULAR AVIATION. This is by the urgent request of Eugene DuBois. The last address in our files showed that Mr. Canfield lived in Cleveland, Ohio, but according to Mr. DuBois, he was not known in that city. Further than this we have no information. If this should come to Mr. Canfield's attention, we will ask him to kindly write to Eugene DuBois, 4855 Jefferson St., Bellaire, Ohio.

* * *

AND so we approach our landing place. I'll be meeting you here next month, accompanied by the suggestions of other readers who are of an argumentive and constructive turn of mind. So long.

J. B. R.

Questions and Answers

(*Continued from page* 104)

cause a considerable difference between the readings of the air-speed meter and the actual ground speed. For example, if the air-speed of the machine is one hundred miles an hour and it is flying with a 30-mile wind, then the ground-speed will be 130 miles an hour, but the air-speed meter will only show 100 m.p.h.

On the other hand, if this same ship is flying against the 30-mile wind, then the ground speed will only be 70 miles an hour. If the wind should be blowing at right angles across the course of the ship, then the relation would be somewhat more complicated.

One of the most recent of drift and ground speed indicators is the one devised by Harold Gatty of "Winnie Mae" fame. By the use of this instrument we can determine the ground speed and also the drift due to side winds. A detailed description of this instrument will be given in a future article.

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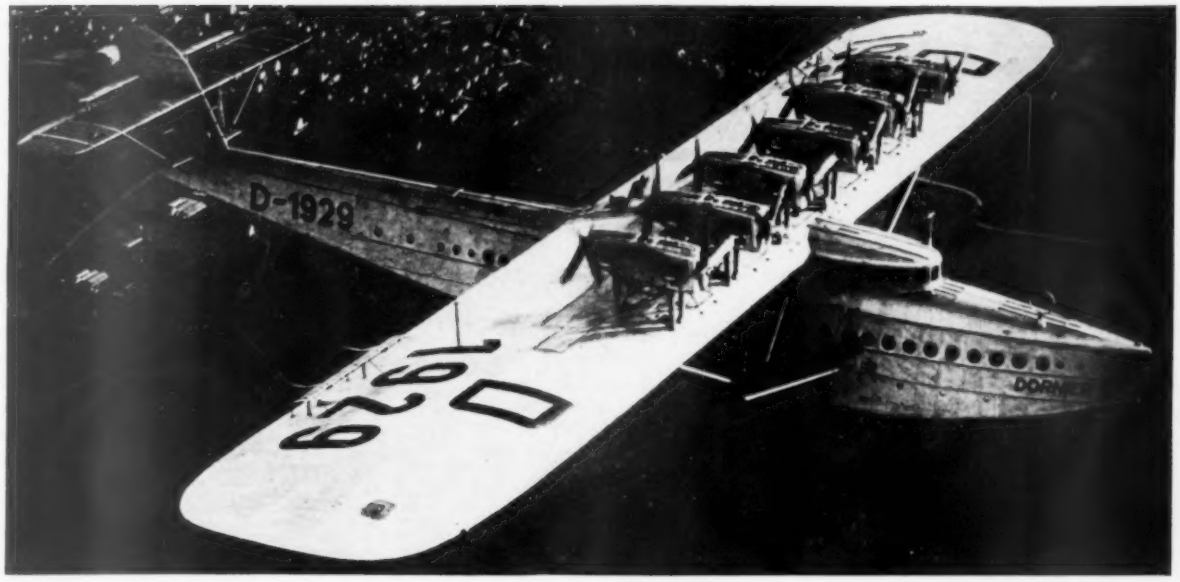

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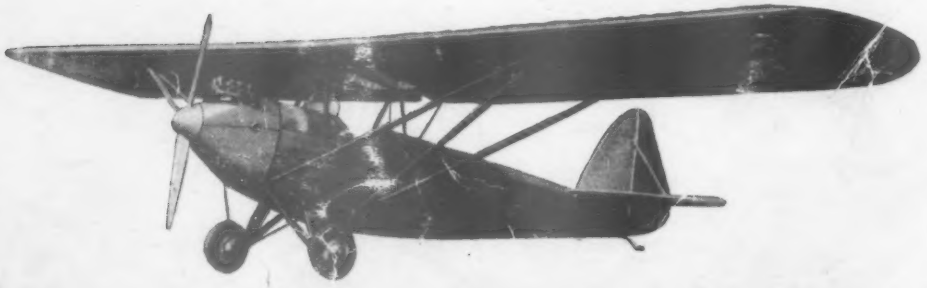

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